

LLRW and 11e.(2) Construction Quality Assurance/Quality Control (CQA/QC) Manual

LLRW and 11e.(2) CQA/QC Manual

TABLE 1 – CQA/QC ACTIVITIES

Work Elements:

Work Elements:

Document Control	Specifications 1-4	Page 4
General Requirements	Specifications 5-23	Page 5
Foundation Preparation.....	Specifications 24-30	Page 40 13
Clay Liner Borrow Material	Specifications 31-35	Page 42 15
Clay Liner Test Pad	Specifications 36-38	Page 43 17
Clay Liner Placement	Specifications 39-55	Page 46 21
Waste Placement with Compactor.....	Specifications 56-70	Page 23 28
Waste Placement without Compactor	Specifications 71-100	Page 29 35
Debris Placement	Page 33	
CLSM Pours	Page 36	
In-Cell Bulk Disposal LLRW Stored Waste	Page 43	
11 E 2 Stored Waste	Page 51	
Cold Weather Placement	Page 44	
Containerized Waste Facility CWF Waste Placement Test Pad	Specifications 101-103	Page 49 56
Containerized Waste Facility CWF Waste Placement	Specifications 104-115	Page 52 59
Interim Rad Cover Placement and Monitoring....	Specifications 116-123	Page 62 71
Temporary Cover Placement and Monitoring	Specifications 124-133	Page 64 74
Radon Barrier Borrow Material.....	Specifications 134-138	Page 70 80
Radon Barrier Test Pad.....	Specifications 139-141	Page 72 82
Radon Barrier Placement	Specifications 142-163	Page 75 86
Filter Zone	Specifications 164-169	Page 84 95
Sacrificial Soil Placement.....	Specifications 170-174	Page 87 97
Rock Erosion Barrier	Specifications 175-180	Page 88 99
Drainage Ditch Imported Borrow	Specifications 181-184	Page 94 101
Drainage Ditches	Specifications 185-190	Page 92 103
Inspection Road	Specifications 191-195	Page 94 106
Permanent Chain Link Fences	Specifications 196-198	Page 96 108
Settlement Monitoring	Specifications 199-204	Page 99 112
Annual As-Built Report.....	Specifications 205-207	Page 102 115

TABLE 2 – MATERIAL SPECIFICATIONS ~~PROPERTIES~~ FOR PORTLAND CEMENT CLSM
[..... Page 117](#)

~~TABLE 3 – MATERIAL PROPERTIES~~SPECIFICATIONS FOR FLY ASH CLSM

FIGURE 1 – LARW Settlement Monuments, May 1, 2006

FIGURE 2 – Class A West Settlement Monuments, ~~rev~~[Rev.](#) 3, September 20, 2011

FIGURE 3 – Mixed Waste Settlement Monuments, ~~rev~~Rev. 2, October 10, 2008
FIGURE 4 – 11e.(2) Settlement Monuments, ~~rev~~Rev. 2, October 10, 2008
FIGURE 5 – Cross Section of 11e.(2) and Class A West Settlement Plate Monument Installation, ~~rev~~Rev. 1, ~~0, 2/16/07~~August 19, 2015
FIGURE 6 – Reserved (~~rev~~Rev. 26a, September 15, 2011)
FIGURE 7 – CWF Cell Construction Requirements, sheet 1 of 2, ~~rev~~Rev. 1, 10/10/07
FIGURE 8 – CWF Cell Construction Requirements, sheet 2 of 2, ~~rev~~Rev. 0, 10/10/07

Appendix A – List of CQA/QC Documentation Forms, ~~rev. 17, September 15, 2011~~
Appendix B – Testing Methods, ~~rev. 6, October 11, 2010~~
Appendix C – Rock Quality Scoring
~~, rev. 14, October 19, 2007~~

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - DOCUMENT CONTROL

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>1) SCOPE: This work element applies to all construction activities in the Class A West and 11e.(2) embankments.</p>		
<p>2) QC DOCUMENTATION APPROVAL: QC documentation shall be approved/rejected by the Lead, QC Embankment Construction<u>QC Supervisor QC Officer</u> and submitted to the Construction QA Officer. The Construction QA Officer shall approve/reject the documentation<u>Quality Assurance.</u></p>	<p>Sign the reports indicating documentation is adequate, correct, and has been accepted by QC. Provide QA with copies of the documentation and obtain their signature on the documentation indicating QA acceptance. Ensure that corrective actions required by QA personnel are accomplished.</p>	<p>Review the documentation generated by QC. Report deficiencies to the Lead, QC Embankment Construction QC Officer QC Supervisor and the Construction QA Officer<u>Quality Assurance.</u> Verify that corrective action has been taken (where required) and recorded on the QC documentation. Countersign reports indicating documentation is adequate, correct, and has been accepted by QA. Record findings on the "Daily Quality Assurance Report".</p>
<p>3) QC DOCUMENTATION FILES: Original QC documents shall be maintained in accordance with CL QA PR 005, Quality Assurance Records at the site. A copy shall be saved into the electronic database.</p>	<p>After the QC documentation has been accepted by QA, a copy of the original shall be saved into the electronic database. Originals of all QC documentation shall be maintained in the site engineering file.</p>	<p>Periodically review the electronic database to ensure the correct documentation is being saved. Periodically review the site engineering files to ensure the correct documentation is being retained by QC personnel.</p>
<p>4) QA DOCUMENTATION FILES: Original QA documents shall be maintained in accordance with CL QA PR 005, Quality Assurance Records at the site. A copy shall be saved into the electronic database.</p>	<p>None</p>	<p>A copy of the original shall be saved into the electronic database and originals maintained in the site QA file.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - GENERAL REQUIREMENTS

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>5) SCOPE: This work element applies to the Class A West and 11e.(2) embankments.</p>		
<p>6) RUNON CONTROL DURING PROJECT: The perimeter berms shall be constructed to a minimum of 3<u>three</u> feet above the ground elevations (GL) shown in the engineering drawings. <u>Berm material will be as specified in Specification 33.</u> The first lift of material shall have an uncompacted thickness of no greater than 12 inches. <u>There is no lift thickness specification for subsequent lifts.</u> Elevations for the berms between the specified ground elevations shall be linearly interpreted between the shown elevations. The berms shall be a minimum of 3<u>four</u>10 feet <u>wide</u> at the top and shall be compacted to 90 percent of a standard Proctor.</p>	<p>Verify that the required berms have been constructed to the specified dimension. Record any findings on the "Daily Construction Report". <u>Conduct laboratory classification (ASTM D2487) and Standard Proctor tests (ASTM D698) at a rate of one test per 5,000 linear feet of berm, with a minimum of one test per berm. Spot check the density</u><u>Conduct one density test per 300 linear feet</u> of the first lift and subsequent lifts of the berm to ensure that it meets specifications. Record density tests on the "Field Density Test" form.</p>	<p>Verify that berms have been <u>tested and</u> inspected by QC personnel <u>and that appropriate density test have been conducted.</u></p>
<p>7) RUNOFF CONTROL DURING PROJECT: Berms shall be constructed around the outside edge of the clay liner<u>Perimeter of waste placement areas</u> to a height of 3<u>three</u> feet. This height is measured as the elevation above the design elevation of the clay liner; or as the elevation above the design-as-built elevation of the liner protective cover; whichever is higher. Berms shall be a minimum of 3<u>three</u> feet wide at the top. <u>Berm material will be as specified in Specification 33.</u> The first lift of material shall have an uncompacted thickness of no greater than 12 inches. <u>There is no lift thickness specification for subsequent lifts.</u> The berm will be constructed on top of the clay liner such that the berm is not in contact with native ground. <u>The berm shall be constructed directly on top of clay liner or liner protective cover that meets or exceeds the berm material and compaction specifications</u><u>has been compacted to at</u></p>	<p>Verify that the required berms have been constructed to the specified dimension. Record any findings on the "Daily Construction Report". <u>Conduct laboratory classification (ASTM D2487) and Standard Proctor tests (ASTM D698) at a rate of one test per 5,000 linear feet of berm, with a minimum of one test per berm. Spot check the</u><u>Conduct one density test per 300 linear feet</u> of the first lift and subsequent lifts of the berm to ensure that it meets the <u>specification is met.</u> Record density tests on the "Field Density Test" form.</p>	<p>Verify that the berms have been <u>tested and</u> inspected, <u>and inspected to the correct criteria</u> by QC personnel.</p> <p><u>Review documentation to verify</u> Verify that the weekly access ramp inspections have been performed and documented.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - GENERAL REQUIREMENTS

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>least 90 percent of a standard Proctor. A <u>minimum</u> distance of 10 feet shall be maintained between the toe of the berm and the toe of the waste. The berms shall be compacted to 90 percent of a standard Proctor.</p> <p>Contact water shall be controlled inside the runoff control berm system. Contact water is defined as any storm water that falls within the runoff berm system in the active, unfinished portions of the embankment. Access ramps that cross runoff berms shall be constructed <u>and maintained</u> to prevent such runoff from leaving the lined portion of the embankment.</p> <p>Fences or other barriers will be installed at the active cell boundary, (the run-off berm and near the radon barrier/waste interface) The barriers will be "chicken wire", snow fence, chain link fence, or herculite (or other materials similar to herculite) secured to "T" posts.</p> <p>Storm runoff for up to a 10-year, 24-hour event that runs off from those portions of the embankment that have been completed to final cover design shall be managed and controlled to prevent such runoff from contacting contaminated waste material in the active unfinished portions of the embankment.</p> <p>After the first lift of radon barrier material for an entire side slope area (i.e., from the toe of waste to the side slope breakover) has been <u>pushed out to the design lift thickness constructed, verified, and approved</u>, the adjacent runoff berm for that side slope area may be removed. During placement of this first lift of radon barrier, there is no minimum</p>	<p>Inspect the access ramps that cross runoff berms on a weekly basis for the presence of runoff control channels and document the inspection on the "Daily Construction Report".</p> <p>Verify fences are installed around the active cell boundary and near the radon barrier/waste interface and document the inspection on the "Daily Construction Report".</p>	<p>Verify that fences are in place and have been inspected by QC personnel.</p>
REVISION: 26d <u>27aXX</u>	page 6 of 138	Date: May 7 <u>October 25, 2012</u> XXXX

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - GENERAL REQUIREMENTS

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
offset to the runoff berm.		
<p>8) MONTHLY BERM INSPECTION: The berms and fences are to be inspected monthly. Inspect for obvious damage to berms and fences. Ensure berm height where roads cross berms.</p>	<p>Inspect the berm on a monthly basis and document the inspection and any corrective actions taken (if required) on the "Daily Construction Report". Marker posts indicating the required berm height should be placed at both sides of a road at the point where the road crosses the berm. This is to aid in identifying damage to the berm due to road traffic. Repair <u>Advise</u> Notify the Project Manager and Review <u>documentation to verify</u> any noted damage of berm or wind dispersal fences and <u>required repairs.</u> advise them on required repairs. After repairs are completed, re-inspect the berm. Continue this process until the berm meets specification. fill low spots to meet the design height.</p>	<p>Verify that the monthly berm inspections have been performed and properly documented. Verify proper installation of marker posts and wind dispersal fences or other barriers.</p>
<p>9) BERM MAINTENANCE: The runon and runoff berms shall be surveyed and improved, as required, by July 1 of each year.</p>	<p>Survey the berms at 100 foot intervals and key points (i.e., <u>changes in direction of the berm</u>). Repair <u>Advise</u> Notify Inform the Project Manager <u>operations of</u> any noted damage and <u>advise them on the required repairs.</u> fill low spots to meet the design height. After repairs are completed, re-inspect the berm. Continue this process until the berm meets specification.</p>	<p>Verify that the berms are surveyed and improved, as required.</p>
<p>10) MOVING OR BREACHING A RUNOFF CONTROL BERM: When moving or breaching a berm, the work must be authorized by the QC officer <u>Lead, QC Embankment ConstructionQC Supervisor</u> prior to commencing work. A temporary breach of a berm may be accomplished without a temporary berm, provided the work may</p>	<p>Review the work to be performed. Document the approval to move or breach a berm on the "Breach of Berm" Form <u>form</u>.</p>	<p>Verify that the approval to move or breach a berm has been properly documented <u>on the Breach of Berm form</u>.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - GENERAL REQUIREMENTS

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<p>beis expected to be completed and the berm replaced the same day. A temporary berm will have the same specifications as a permanent bermbe designed to ensure runoff is contained within the cell and approved by the Site EngineerEngineering Manager.</p> <p><u>A berm may be partially or completely breached during cover construction (e.g., one or more of the requirements in the Runoff Control During Project specification above is no longer met) as long as runoff control is maintained from potentially contaminated areas to clean areas as approved by the Engineering Manager.</u></p>	<p><u>Ensure runoff control is maintained to prevent potentially contaminated liquids running into clean areas and document on the Daily Construction Report.</u></p>	<p><u>Review Daily Construction Reports to ensure proper documentation.</u></p>
<p>4) —NUCLEAR DENSITY/MOISTURE GAUGE CALIBRATION: Each nuclear density gauge shall have current calibration, performed in accordance with the manufacturer's specifications, prior to use on the project.To ensure proper calibration, a sand cone density test shall be performed jointly with five percent of the nuclear density test. The frequency of sand cone tests shall be reduced to two percent of the nuclear density tests for the clay liner or radon barrier to minimize the damage to these low permeability layers from the sand cone test. Holes in the clay liner and radon barrier created by the nuclear density gauge shall be filled with dry bentonite.</p> <p>11) To ensure proper calibration, an oven drying test shall be performed jointly with five percent of the nuclear moisture tests.</p>	<p><u>Check calibration labels to ensure equipment is calibrated prior to using.</u>Perform sand cone density tests and oven drying tests to calibrate the nuclear moisture/density gauge. Review the results with the Construction QA Officer.</p> <p>When performing the sand cone density test or the oven drying test to calibrate the nuclear moisture/density gauge, the data obtained from the sand cone density test or the oven drying test takes precedence over the data obtained from the nuclear moisture/density gauge.</p>	<p>Review the results with the QC officer. Verify that the data obtained from the sand cone density tests and oven drying tests (when performed) are used in the calculations for ultimate acceptance of the tested media.</p>
<p>12) SAMPLING LOCATIONS FOR LOTS: For sample locations chosen by random numbers, two random numbers shall be employed. The first</p>	<p>Generate random numbers for each lot by using a calculator or computer with a random number generator. Locate the test location within five feet of</p>	<p>Verify that the test methods<u>sample locations</u> are being chosen by random number.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - GENERAL REQUIREMENTS

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>number (X) shall be between zero⁰ and the largest east-west distance of the lot. The second number (Y) shall be between zero⁰ and the largest north-south distance of the lot. The test location will be located at X feet east and Y feet south of the north-west corner of the lot. For a linear lot (e.g. the intersection of lifts), a single random number shall be generated.</p> <p>For borrow sources which consist of multiple lots which will be sampled by a single test pit, the test pit shall be located by two random numbers as outlined above and will be the same for all lots.</p> <p>13) TEST METHODS: All tests shall be performed in accordance with the test methods specified in Appendix B.</p>	<p>the location specified by the random numbers. If the sample location is outside the lot, generate two new random numbers.</p>	
<p>14) QA AUDITING: EnergySolutions shall contract with an independent firm to perform an annual audit of the CQA/QC <u>program</u>. The auditor shall:</p> <p><u>A. audit at least 15% percent</u> of the CQA\QC documentation; and</p> <p><u>B. observe QC procedures</u> for field density/moisture tests, classification tests, Proctors, permeability tests, and surveying.</p> <p><u>The audits must be coordinated so that field activities are audited. Each audit shall include observations of field activities that occur while the auditor is on-site.</u> A copy of the auditor's report shall be submitted to the <u>DWMRC</u>.</p>	<p>Schedule times with the QA auditor to observe the specified testing. Cooperate with QA auditor in the review of QC documentation.</p>	<p>Verify that the test methods being use to conduct the tests are the methods specified in Appendix B.</p>
<p>15) TEST FAILURE PROTOCOL<u>PROTOCOL</u>: Unless otherwise specified in this Manual, any failing test shall be addressed as follows:</p>	<p><u>Document all failing tests and corrective actions for those failures. When applicable, obtain documentation of DRCDWMRC notification.</u></p>	<p><u>Ensure documentation is present for all failed tests. Review documentation and corrective actions. Notify DRCDWMRC as required. Provide QC with documentation of the DRCDWMRC notification.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - GENERAL REQUIREMENTS

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>A. Document the failing test result in applicable QC records.</p> <p>B. Notify construction personnel of the failing test result and re-work as needed.</p> <p>C. After re-work is complete, re-test and document results.</p> <p>D. If the re-test results pass, approve the work.</p> <p>E. If the re-test results fail, directrequire further re-work until passing results are achieved.</p> <p>F. Any circumstance where re-work is not desired or possible shall be documented on a Condition—Nonconformance Report (NCR). The Director of Engineering or designee shall be responsible for determining and originating a Condition Report. Any circumstance addressed via Condition ReportNCR in accordance with this specification requires DRCDWMRC notification and written approval prior to proceeding.</p>		
<p><u>16) QUALITY OF ROCK: Applies to the following cover materials.</u></p> <p><u>11e.(2): Filter Zone, Top Rock and Side Rock.</u></p> <p><u>Class A West: Surface Layer Gravel and Ditch RiprapType A Filter Zone Rock, Type B Filter Zone Rock, Type A Rip Rap and Type B Rip Rap.</u></p> <p><u>The rock shall have a "Rock Quality" score of at least 50 based on the following tests: Specific Gravity (ASTM C128), Absorption (ASTM</u></p>	<p><u>As described in NUREG-1623, appendix F, perform at least one petrographic examination for each rock source in accordance with ASTM C295. If a combination of limestone, sandstone, and igneous rock is found for a source, percentages of each type of material shall be determined for scoring.</u></p> <p><u>Perform Na soundness, LA abrasion, absorption, and specific gravity testing at a rate of one set of tests per 10,000 cubic yards of rock with a minimum of four</u></p>	<p><u>Verify the frequency of laboratory quality control tests and compliance of test results.</u></p> <p><u>Perform quality assurance testing for Rock Quality parameters at a minimum of one set of tests per 100,000 cubic yards of rock. A minimum of one set of tests is required each year that filter zone is placed.</u></p>
<p>REVISION: 26d<u>27aXX</u></p>	<p>page 10 of 138</p>	<p>Date: May 7<u>October 25, 2012XXXX</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - GENERAL REQUIREMENTS

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p><u>C127), Sodium Soundness (ASTM C88), and L.A. Abrasion (ASTM C131 or ASTM C535). The procedures for scoring "Rock Quality" are found in Appendix C</u></p> <p><u>17) QC PROCEDURES: Quality Control procedures to perform the actions described in this Manual are designated CL-QC-PR and maintained by document control. Other QC procedures are described in designated ASTM tests. Titles of procedures include "Quality Control Inspections and Testing", "Standard Practice for Achieving Certified AMRL Results", and "Lift Approval Using an 826 Compactor." Furthermore, ASTM references within this Manual are additional procedures.</u></p> <p><u>— CONSTRUCTION PHASE (PHASE): Construction phases described in this Manual are defined as specific projects to specific embankment construction activities (e.g., cover construction over specifically designated portion of the embankment). Waste placement is ongoing and is therefore not considered a construction phase.</u></p>	<p><u>tests per embankment. Samples may be collected at the source location or from onsite stockpiles. Record the location of all collected samples in the Sampling Log.</u></p>	<p><u>Record the samples on the "Sampling Log". Promptly report results to the Construction QA Officer so that a comparison of QA and QC testing results can be made. The Construction QA Officer, in consultation with the Lead, QC Embankment Construction, shall be responsible for determining the adequacy of correlation and documentation of the rationale used to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The Construction QA Officer, in consultation with the Lead, QC Embankment Construction, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of the quality assurance sampling in the "Daily QA Report".</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - GENERAL REQUIREMENTS

SPECIFICATION

QUALITY CONTROL

QUALITY ASSURANCE

18) PRE-CONSTRUCTION DOCUMENTATION

& COMMUNICATION: Prior to each construction phase, and at the beginning of each construction season for ongoing phases, construction personnel will review construction phase-specific drawings, specifications, and procedures. ~~This~~A pre-construction meeting will also discuss key personnel and requirements for the construction phase. The construction phase-specific drawings shall be submitted to the Division of Waste Management and Radiation Control (DWMRC) prior to construction.

As waste placement is ongoing, this pre-construction documentation & communication section is not applicable to waste placement. Waste placement will be completed in accordance with this Manual and ~~License Drawings and approved engineering drawings within Radioactive Material License UT2300249~~listed in Groundwater Quality Discharge Permit UGW450005.

19) PROJECT MANAGER: The Project Manager shall be designated at the beginning of each construction phase. If not designated or not available, the Engineering Manager shall assume the role of the Project Manager.

20) NATIVE MATERIAL: Natural ~~material~~soil from ~~adjacent~~—areas surrounding the Clive Facility. Native material ~~may be clay or soil and~~ may be used as ~~waste~~-fill; during waste placement or in the construction of liner and cover provided the material meets project specific specifications.

21) OFF-SITE FILL/BACKFILL MATERIAL: Fill

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - GENERAL REQUIREMENTS

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p><u>or backfill material may consist of licensed waste, native soils from Sections 5 and 29 material, or other materials from off-site sources.</u></p> <p><u>Fill or backfill material from off-site sources shall conform to the following requirements:</u></p> <p><u>A. It shall consist of only natural soil and rock.</u></p> <p><u>B. It shall not exceed the Exempt limit of UAC R313-19-13(2)(a)(i)(B).</u></p> <p><u>C. It shall not contain any of the following:</u></p> <ol style="list-style-type: none"> <u>1. Biodegradable materials.</u> <u>2. Hazardous waste, including but not limited to listed or characteristic waste.</u> <u>3. Material regulated by any other State or Federal regulatory program.</u> <p><u>D. It shall only be used in the waste portions of the Class A West or Mixed Waste embankments.</u></p> <p><u>E. The following records shall be maintained:</u></p> <ol style="list-style-type: none"> <u>1. The identity / location of the source(s) of the material.</u> <u>2. The volume and weight of the material.</u> <u>3. Documentation that the material meets the prohibitions of requirement C of this specification Specification 21.C.</u> <p><u>22) DWMRC EXEMPTION: Any requirement within this Manual may be exempted by the Director of the Division of Waste Management and Radiation Control (DWMRC). Exemptions will be confirmed in writing.</u></p>		

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - GENERAL REQUIREMENTS

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<div>23) DWMRC NOTIFICATION: All DWMRC notifications within this Manual shall include a copy to the DWMRC Section Manager. Unless otherwise stated in the specification all notifications will be in the form of a letter.</div>		

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - FOUNDATION PREPARATION

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>24) SCOPE: This work element applies to the Class A West and 11e.(2) embankments.</p>		
<p>25) CLEARING AND GRUBBING: Remove vegetation, debris, organic, or deleterious material from areas to be excavated for construction of cells. Grubbing depth will depend on the type of vegetation, debris, organic, or deleterious material on the site. If the area is free of these materials then no clearing and grubbing will be necessary.</p>	<p>Inspect the area once clearing and grubbing has been completed. Record observations and corrective actions (where required) on the "Daily Construction Report".</p>	<p>Verify <u>and document</u> that the clearing and grubbing has been inspected by QC.</p>
<p>26) EXCAVATION: Excavation shall be made to the lines, grades, and dimensions prescribed in the approved <u>construction phase-specific drawings, plans.</u> Any over excavation shall be backfilled with <u>select-native</u> materials and compacted to 95 percent of Standard Proctor. The uncompacted lift thickness shall not exceed <u>12-9nine</u> inches.</p>	<p>Observe the cell excavation. Record observations and corrective actions taken (where required) on the "Daily Construction Report".</p> <p>In areas of over excavation, conduct in-place density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as a maximum of 10,000 square feet of a lift of a specified type of material. Test locations shall be chosen on the basis of random numbers <u>(described in Specification 12).</u></p> <p>a. Approve lots which meet the specified compaction. b. Rework and retest lots not meeting the specified compaction.</p> <p>Proctors shall be performed at a rate of one test per 100,000 square feet for each material type. At least one proctor shall be performed for each material type. Record the location of the sample on the "Sampling Log".</p>	<p>Verify the frequency of tests and compliance of test results. Observe, at a minimum, five percent of the tests performed by QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed. <u>Observe QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed correctly.</u></p>
<p>27) SCARIFICATION AND COMPACTION: The foundation shall consist of either:</p> <p style="text-align: center;">a</p> <p>A. <u>For in-situ sands: Inspect the surface for</u></p>	<p>Observe-Inspect and verify the foundation <u>meets the proctor compaction specifications.</u> Record observations and corrective actions on the "Daily QC Report".</p> <p>Conduct in-place density tests at a rate of one test per</p>	<p>Verify the frequency of tests and compliance of test results. Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - FOUNDATION PREPARATION

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>cracks. If cracking of the surface is observed, then scarify the in-situ sands and compact to at least 95 percent of a Standard Proctor. If no cracking is observed, then scarification is not necessary prior to compacting to at least 95 percent of a Standard Proctor.</p> <p>scarifying the in-situ clays to at least six inches and compacting it to at least 95 percent of a standard proctor or</p> <p>b. inspecting the in-situ sands and if cracking of the surface is observed, then scarify the in-situ sands to at least six inches and compact it to at least 95 percent of a standard proctor, or, if no cracking is observed, then</p> <p><u>B. compacting the in-situ sands soils to at least 95 percent of a standard proctor without prior scarification</u></p> <p><u>For in-situ non-sandy soil: Scarify the in-situ soils to at least six inches and compact it to at least 95 percent of a Standard Proctor.</u></p> <p><u>B.</u></p> <p>28) FINAL GRADING: <u>The foundation surface shall be smooth-drum rolled and moist prior to clay liner placement. The foundation shall be free from surface debris, soft (wet) spots greater than 3three inches deep, and loose soil areas with a loose surface greater than 3three inches deep. Foundation shall be at or below gradedesign elevation.</u> <u>The foundation for the clay liner shall be fairly smooth and free from clods, rocks, soft spots, wet areas, etc. Foundation elevations shall be at grade or below grade.</u></p>	<p>lot and record the results on the "Field Density Test" form. A lot is defined as a maximum of 10,000 square feet of a 6-inch lift of a specified type of material. Test locations shall be chosen on the basis of random numbers <u>(described in Specification 12).</u></p> <p>Proctors shall be performed at a rate of one test per 100,000 square feet for each material type. At least one proctor shall be performed for each material type. Record the location of the sample on the "Sampling Log".</p> <p>Survey the foundation on a 50 foot^{ft} grid and at key points <u>(i.e. embankment break lines).</u> Final survey measurements will be documented and provided to the QC officer<u>Lead, QC Embankment ConstructionQC Supervisor and Construction QA Officer</u><u>Quality Assurance.</u></p> <p>a. Indicate where the foundation meets design line and grade.</p> <p>b. Rework and resurvey areas not meeting the specified grade.</p>	<p>frequency and that the documentation is being completed. <u>Observe QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed correctly.</u></p> <p>Review the final survey data. Verify the frequency of the survey points.</p>
<p>29) UNSUITABLE MATERIAL: Remove</p>	<p>Define areas of unsuitable material and advise <u>notify</u></p>	<p>Verify that the removal of unsuitable material has been</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - FOUNDATION PREPARATION

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
unsuitable material as required. Unsuitable material is non-soil material or soil which cannot be reworked to meet the compaction criteria.	the Project Manager that such areas must be removed. Observe the areas once the unsuitable material has been removed. Report corrective actions (where required) on the "Daily Construction Report".	properly documented.
30) FOUNDATION APPROVAL: Foundation to shall be approved by <u>the Engineering Manager, Engineering and Maintenance (or designee).</u> P Prior to covering, the Engineering Manager shall prepare a "Notice of Acceptance" indicating that the foundation meets the required specifications. Construction QA Officer.	<u>Accompany the Engineering Manager on a walk-through of the foundation area. Obtain the "Notice of Acceptance" from the Construction QA Officer, Engineering and Maintenance.</u> Engineering Manager (or designee) before construction of the clay liner begins.	Provide a "Notice of Acceptance" to the QC officer indicating that the foundation meet the required specifications. <u>Confirm that QC has obtained the Notice of Acceptance.</u>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - CLAY LINER BORROW MATERIAL

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>31) SCOPE: This work element applies to the Class A West and 11e.(2) embankments.</p>		
<p>32) CLEARING AND GRUBBING: Remove vegetation, debris, organic, or deleterious material from areas to be used for borrow. Grubbing depth will depend on the type of vegetation, debris, organic, or deleterious material on the site. If the area is free of these materials then no clearing and grubbing will be necessary.</p>	<p>Inspect the area once clearing and grubbing has been completed. Record observations and corrective actions (where required) on the "Daily Construction Report".</p>	<p>Verify that the clearing and grubbing has been inspected <u>and recorded</u> by QC.</p>
<p>33) MATERIAL: Satisfactory material shall be defined as <u>CL_z or and ML_z or CL-ML</u> soils based on the Unified Soil Classification <u>with at least 85 percent passing the No. 200 sieve (silt and clay), a plasticity index (PI) between 10 and 25, and a liquid limit (LL) between 30 and 50</u> with at least 85 percent passing the No. 200 sieve (silt and clay), a plasticity index (PI) between 10 and 25, and a liquid limit (LL) between 30 and 50. The clay shall also have a dry clod size less than or equal to 1 inch.</p>	<p>Perform laboratory classification tests (<u>ASTM D 2487</u>) at a rate of 1<u>one</u> test per lot prior to use of material in the clay liner. A lot is defined as a maximum of 3,000<u>5,000</u> cubic yards (compacted) of specified material type. Record the location of the classification sample on the "Sampling Log".</p> <p><u>a. Approve lots (which meet the specified classification) for use in the clay liner.</u></p> <p><u>b. Lots not meeting the specified classification cannot be used.</u></p> <p>a. Approve lots (which meet the specified classification) for use in the clay liner.</p> <p>b. Lots not meeting the specified classification can not be used.</p>	<p>Verify the frequency of laboratory tests and compliance of test results.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - CLAY LINER BORROW MATERIAL

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>34) PROTECTION: The clay borrow material shall be handled in such a manner as to prevent contamination with radioactive waste material or other deleterious material. The in-placeAcceptable clay <u>borrow material</u> may contain up to five percent additional rocks <u>(less than or equal to one inch)</u> and sand above the content found in the classification test.</p>	<p>Visually check clay liner materials for contamination by foreign materials. <u>If any foreign materials are identified, the percentage of foreign material shall either be estimated in accordance with ASTM D2488 or calculated in accordance with ASTM D2487. Document findings on the Daily Construction Report. Advise</u>Notify the Project Manager to have operations remove<u>Remove or rework</u> clays which have been contaminated above the specified requirements. <u>Re-inspect the clay liner and Document</u>document corrective actions (where required) on the "Daily Construction Report".</p>	<p>Verify that the clay liner <u>material</u> is being inspected for contaminates<u>contaminants</u> and that <u>the inspection</u>and corrective actions (if required) are properly documented.</p>
<p>35) PROCESSING: These procedures may be used to provide suitable material for construction of the clay liner.</p> <p>A. 1) Apply <u>If used, apply</u> deflocculant at a rate determined by the production engineer<u>Manager, Engineering and Maintenance</u>Engineering Manager (based on test pad data). If used, the choice of deflocculant and the application rate shall be verified in the Clay Liner Test Pad.</p> <p>B. 2) Mix the deflocculant thoroughly into the soils by tilling or similar action.</p>	<p>Measure the mixing areas and verify that the application rate of the deflocculant is equal to or greater than the rate determined by the production engineer<u>Manager, Engineering and Maintenance</u>Engineering Manager. Record the size of the mixing areas and the amount of deflocculant applied on the "Embankment Construction Lift Approval Form".</p> <p>Observe the mixed clay and advise<u>notify</u> the Project Manager of areas which are <u>not</u> adequately mixed. <u>Re-inspect after corrected. Document observations and corrective actions, if required, on the Daily Construction Report.</u></p>	<p>Verify that the size of the mixing areas and the amount of deflocculant applied has been properly documented.</p> <p>Verify that the clay is being inspected <u>correctly and the inspection documented.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - CLAY LINER TEST PAD

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>36) SCOPE: This work element applies to the Class A West and 11e.(2) embankments.</p>		
<p>37) NOTICE OF TEST PAD CONSTRUCTION: The <u>clay liner</u> test pad plan shall be approved by provided to <u>approved by the DRC/DWMRC</u>. The <u>clay liner test pad plan shall be provided to the DWMRC at least 14 calendar days prior to the test pad construction. If DWMRC has not provided approval or deficiency notification prior to the end of 14 calendar days, construction may proceed as proposed in the test pad plan.</u></p> <p>The DRC/DWMRC shall be notified 2448 <u>48</u> hours in advance of the start-up of test pad construction.</p>	<p>Obtain documentation confirming that the test pad plan has been approved by provided to <u>approved by the DRC/DWMRC or the 14 calendar day period has ended.</u></p> <p>Verify that <u>Obtain documentation confirming that the DRC/DWMRC</u> has been notified, as required.</p>	<p>Verify that the test pad plan has been approved by the DRC. Verify that the DRC has been notified as required. <u>Verify that the test pad has been approved by provided to the DRC/DWMRC at least 14 calendar days prior to construction of the test pad. Provide QC with documentation of DWMRC approval or documentation that the 14 calendar day period has expired.</u></p> <p><u>Notify the DRC/DWMRC 482448 hours in advance of the start-up of test pad construction. Provide QC with documentation of -DWMRC notification.</u></p>
<p>2)38) TEST PAD(S): A <u>test pad with minimum dimensions of approximately 60 feet by 75 feet</u> large test pad will be constructed using the procedure proposed for construction of the clay liner.</p> <p><u>Prior to use of manually operated compaction equipment, a small test pad with minimum approximate minimum dimensions of five5 feet by five5 feet (or other sized appropriately for the equipment used) will be constructed. The purpose of this small test pad is to establish equipment and procedures for construction of clay liner in locations where large equipment is not practical (e.g. repairs). If manually operated compaction equipment is not used on the project, a small test pad is not required.</u></p>	<p>Observe the construction of test pads. Measure <u>each</u> test pads to ensure that they are it <u>is</u> constructed to <u>at least</u> the size indicated <u>required</u>. Record the test pad size on the "Embankment Construction Lift Approval Form".</p> <p>The large test pad shall be divided into three lots per lift (approximately 1,500 square feet per lot). Each lift of the small test pad shall equal a lot.</p>	<p>Observe the construction of the test pads. Verify that the test pad has been measured and is properly documented.</p>
<p>REVISION: 26d <u>27aXX</u></p>	<p>page 20 of 138</p>	<p>Date: May 7 <u>October 25, 2012XXXX</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - CLAY LINER TEST PAD

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>A new <u>clay liner</u> test pad shall be constructed each time there is a change in specifications, construction procedures, <u>unified soil classification</u>, or types of equipment. , — unified soil classification, or QC testing equipment or procedure.</p> <p><u>Clay liner Test-test</u> pads are to be constructed and tested in accordance with the following specifications:</p> <p>A. <u>Prior to compaction, conduct at least one classification and gradation test for each test pad.</u></p> <p>B. <u>Place the clay in at least three lifts with the first lift uncompacted thickness not exceeding twelve inches. Remaining lifts shall have a loose material thickness not exceeding nine inches for each lift.</u></p> <p>A-C. <u>The clay material will be inspected for have a dry clod size during placement of each lift of clay liner less than or equal to one inch.</u></p> <p>B-D. <u>2</u> The clay is to be placed and</p>	<p><u>Conduct classification and gradation tests (as described in Appendix B) at a rate of one of each type of test per test pad.</u></p> <p>Measure the lift thickness at a rate of 1-one test per lot. Record thicknesses on the “Embankment Construction Lift Approval Form”.</p> <p>Inspect the loose clay material during the unloading and spreading process for each uncompacted lift to ensure any dry clods that are present are less than or equal to (1)one inch. <u>Advise/Notify the Project Manager to have operations remove clods greater than one inch. Record inspection of the clod size on the “Embankment Construction Lift Approval Form” and re-inspect the uncompacted lift if necessary. Record any corrective actions performed on the Daily Construction Report.</u></p> <p>Verify with the project manager that the same or similar type equipment and compaction efforts will be used in the cell for construction of the clay liner. Record type of equipment used, and number of passes</p>	<p><u>Verify the frequency of tests and compliance of test results.</u></p> <p>Verify that the number of lifts and lift thicknesses have <u>has</u> been documented. Verify that the clod size inspection has been performed and documented for each uncompacted lift thickness.</p> <p><u>Verify that the dry clod size inspection has been performed and documented, including corrective actions as necessary.</u></p> <p>Verify equipment used and the number of passes made in preparing the test pad are those to be used during the construction of the clay liner. Perform a minimum of 1-one visual inspection per test pad.</p>
REVISION: 26d <u>27aXX</u>	page 21 of 138	Date: May 7 <u>October 25, 2012XXXX</u>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - CLAY LINER TEST PAD

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>compacted by equipment proposed for use during construction of the clay liner.</p>	<p>on the "Embankment Construction Lift Approval Form".</p>	<p>Verify the frequency of measurements and compliance of test results.</p>
<p>C-E.3. The lifts of clay shall be bonded by: a providing a rough upper surface on the underlying layer of clay liner. The surface should have changes in grade of approximately one inch or more at a rate of two <u>or more</u> per linear foot.</p>	<p><u>Perform a visual inspection to Verify-verify</u> that there are adequate changes in grade. <u>Any areas of concern shall be verified</u> by placing a straight edge at least two feet long on the surface <u>and counting</u>. Count the number of points approximately one inch or more below the straight edge. <u>Notify the Project Manager of any deficiencies. Re-inspect after the Project Manager has corrected deficiencies.</u></p>	<p>Verify the frequency of tests and compliance of test results.</p>
<p>-OR-</p> <p>b) by compacting with a sheepsfoot with feet approximately two inches longer than the lift thickness.</p> <p>D-E.4. The clay is to be compacted to at least 95 percent of a standard Proctor with a moisture content of between threeone-half a percentage points below optimum to and five percentage points over optimum. Compaction of the large test pad is to be accomplished by at least four passes of suitable compaction equipment.</p>	<p>-OR-</p> <p>Verify that the feet on the sheepsfoot compactor are approximately two inches longer than the lift thickness.</p> <p>Conduct in-place moisture-density tests at a rate of one test per lot, <u>with a minimum of three tests per lift for large test pads and one test per lift on small test pads.</u> The test location shall be chosen on the basis of random numbers <u>(described in Specification 12).</u> Record the test result on the "Field Density Test" form.</p> <p>a. Approve lots which meet the specified moisture and compaction.</p> <p>b. <u>Notify the Project Manager of lots not meeting the specified permeability to have the areas reworked</u>Rework and retest lots not meeting the specified moisture or compaction.</p> <p>c. <u>Retest (moisture/density and permeability) lots after rework has been completed.</u></p> <p>d. Any additional work under b. shall be included in the test pad construction method.</p>	<p>Verify the frequency of tests and compliance of test results.</p>
<p>E-G. <u>5.</u> The clay is to be constructed to provide a permeability less than or equal to 1×10^{-6} cm/sec. Permeability testing on the bottom lift will be performed at the surface. Permeability <u>testing</u> on the second lift will be performed <u>≥ greater than or equal to 2two</u></p>	<p>Conduct in-place permeability tests at a rate of one test per lot per lift. The permeability test shall be run <u>within fivein close proximity to 5 feet of</u> the moisture-density test (see Appendix B). Record the test result on the "Field Permeability Test" form.</p>	<p><u>Verify the frequency of tests and compliance of test</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - CLAY LINER TEST PAD

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>inches" below the surface. Permeability testing on the third lift will be performed \geq <u>greater than or equal to 4four inches</u>" below the surface.</p> <p>F. 6.At least one PI, LL,classification and gradation test shall be conducted for each test pad.</p> <p>G.H. 7.The procedures used to construct the test pad shall be reviewed and approved by the <u>certifying engineer</u>a Utah licensed Professional Engineer. The test must be approved by a Professional Engineer.</p> <p>I. 8.The test pad certification report shall be provided to<u>procedures approved by used to construct the test pad shall be reviewed and approved by</u> the DRC<u>DWMRC</u> prior to using the new test pad construction method. <u>However, if the DWMRC has not provided approval or deficiency notification prior to the end of 14 calendar days from the time the certification report was submitted, construction may proceed using the new construction method.</u></p>	<p>a. Approve lots which meet the specified permeability.</p> <p>b. <u>Notify the Project Manager of lots not meeting the specified permeability to have the areas reworked.</u>Rework and retest lots not meeting the specified permeability</p> <p>c. <u>Retest (moisture/density and permeability) lots after rework has been completed.</u></p> <p>ed. Any additional work under b. shall be included in the test pad <u>certification report</u>construction method.</p> <p>Conduct PI, LL,classification and gradation tests (as described in Appendix B) at a rate of one of each type of test per test pad.</p> <p>Provide the <u>Utah licensed Professional certifying e</u>Engineer with copies of the documentation for the test pad for review and approval.</p> <p>Obtain documentation confirming the DRC approval of the test pad.<u>Obtain documentation confirming that the test pad certification report has been approved by the DWMRC or the 14 calendar day period has ended.</u></p>	<p>results<u>Verify that the PI, LL, and gradation tests have been conducted and documented</u></p> <p>Verify that proper approval has been obtained for the test pad and that the necessary construction procedure documents are in place for use during clay liner construction.</p> <p>Verify that proper approval has been obtained for the test pad and that the necessary construction procedure documents are in place for use during clay liner construction.<u>Verify that the test pad certification report has been provided to the DWMRC. Provide QC with documentation of DWMRC approval or documentation that the 14 calendar day period has expired.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - CLAY LINER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>39) SCOPE: This work element applies to the Class A West and 11e.(2) embankments.</p>		
<p>40) LIFT IDENTIFICATION: Each lift shall be given a discrete—designation<u>unique lift identification number</u> for testing and surveying purposes.</p>	<p>Assign a lift identification number to each lift. Use the lift identification number to identify all paper work for that lift.</p>	<p>Verify that a lift identification number has been assigned to each lift. Verify that the lift identification number is used on all paper work for that lift.</p>
<p>41) PLACEMENT: The clay liner will be prepared, placed, and compacted using the same type of equipment and mixing and compacting procedures that were approved in the test pad.</p>	<p>Observe the clay liner placement. Record the equipment used to place the clay liner and any corrective actions (where required) on the "Embankment Construction Lift Approval Form".</p>	<p>Verify the equipment used to construct the clay liner has been documented and that it is the same type of equipment used to construct the test pad.</p>
<p>42) LIFT BONDING: The lifts of clay shall be bonded by: providing a rough upper surface on the underlying layer of clay liner<u>lift</u>. The surface should have changes in grade of approximately one inch or more at a rate of two <u>or more</u> per linear foot.;</p> <p style="text-align: center;">—OR—</p> <p style="text-align: center;">2) by compacting with a sheepsfoot with feet approximately two inches longer than the lift thickness.</p>	<p><u>Perform a visual inspection to verify</u> Verify that there are adequate changes in grade. <u>Any areas of concern shall be verified</u> by placing a straight edge at least two feet long on the surface. <u>Count and counting</u> the number of points approximately one inch or more below the straight edge. <u>Notify the Project Manager of any deficiencies. Re-inspect the surface after corrective actions have been completed. Document any deficiencies and corrective actions taken on the Daily Construction Report.</u></p> <p style="text-align: center;">—OR—</p> <p style="text-align: center;">Verify that the feet on the sheepsfoot compactor are approximately two inches longer than the lift thickness.</p>	<p>Verify the frequency of measurements and compliance of test results.</p>
<p>43) LIFT THICKNESS: The first lift of material shall have an uncompacted thickness of no greater than 12 inches. For the remaining lifts, the loose lift thickness shall not exceed the lesser of the lift thickness used to construct the test pad or nine inches.</p> <p>A. Thickness for the lift will be established by installing grade poles on at least a 70-foot grid and at all control points. The grade poles must</p>	<p>Verify that the required grading tolerance is achieved as follows:</p> <ol style="list-style-type: none"> Ensure that the required frequency for placement of grade poles has been met. Compare soil level with the marked level on the grade poles. Use a string line where necessary<u>Visually check</u> between poles to check for high or low spots. Define high out of specification areas and <u>advise notify</u> the Project Manager to rework those areas. 	<p>Observe, at a minimum, five percent of the measurements performed by the QC personnel <u>every lift</u> to ensure that the measurements are being performed correctly. Verify that the measurements are being performed at the correct frequency and that the documentation is being completed. Verify that the clod size inspection has been performed and documented for each uncompacted lift thickness.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - CLAY LINER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>not be installed deeper than one inch into the underlying clay liner. The grade poles must be marked at the appropriate depth to establish the grade. After the grade for the lift has been checked and approved by QC personnel, the grade poles shall be removed.</p> <p>The clay material shall have a dry clod size less than or equal to one inch. will be inspected for dry clod size during placement of each lift of clay liner</p> <p style="text-align: center;">- OR -</p> <p><u>B. Survey to determine lift thickness using the same grid spacing described in Specification 43.A. Survey equipment shall have a tolerance no more than ± 0.1 foot.</u></p> <p><u>The clay material shall have a dry clod size less than or equal to one inch.</u></p>	<p>e. Review <u>Re-inspect</u> areas reworked and approve areas meeting criteria.</p> <p>f. Continue "b" through "d" above until all areas meet criteria.</p> <p>g. Indicate areas meeting criteria on the "Embankment Construction Lift Approval Form".</p> <p style="text-align: center;">- OR -</p> <p>a. <u>Verify survey equipment is within a tolerance of ± one 0.1 foot calibration.</u></p> <p>b. <u>Verify correct set-up and operation of equipment.</u></p> <p>c. <u>Visually check between survey points for high or low spots.</u></p> <p>d. <u>Define high out of specification areas and notify the Project Manager to rework those areas.</u></p> <p>ee. <u>Document survey results on a survey report.</u></p> <p>Dig a hole and measure the loose lift thickness at a rate of one per lot. A lot is defined as 10,000 square feet of a single lift and record on the "Lift Approval Form". The location of the measurement shall be chosen on the basis of random numbers.</p> <p>a. Approve lots which meet the specified lift thickness.</p> <p>b. If the thickness is greater than the specified thickness, measure the thickness at four points (north, east, south, and west) within ten feet of the first measurement. Average the five measurements together.</p> <p>c. Approve lifts with an average less than or equal to the specified lift thickness.</p> <p>d. Rework and retest lots with an average lift thickness greater than the specified lift thickness.</p> <p>Inspect the loose clay material during the unloading and spreading process for each uncompacted lift to ensure any dry clods that are present are less than or equal to one (1) inch. <u>Advise/Notify the Project Manager to have operations remove clods greater than one inch.</u> Record inspection of the clod size on the</p>	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - CLAY LINER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
	<p>"Embankment Construction Lift Approval Form". <u>Re-inspect and Rrecord any corrective actions performed on the Daily Construction Report.</u></p>	
<p>44) KEYING-IN: Segments of cell clay liner constructed at times more than 30 days apart from each other shall be keyed-in to each other at vertical steps no greater than nine inches and at least twice as wide as they are high. <u>by one of the following two methods:</u></p> <p><u>A. Key-in vertical steps no greater than nine inches and at least twice as wide as they are high.</u></p> <p style="text-align: center;">- OR -</p> <p><u>B. Ssloping the full thickness of old liner at a maximum slope of 5:1.</u></p> <p><u>The surface shall be maintained in accordance with the Liner Drying Prevention specification below.</u><u>Specification 47.</u></p>	<p>Verify that the new liner has been properly keyed-in to the existing liner. Record deficiencies on the "Embankment Construction Lift Approval Form".</p>	<p>Verify that the keying-in of the liner has been documented.</p>
<p>45) COMPACTION: Clay liner material will be compacted to at least 95 percent of standard Proctor with a-moisture content between optimum threeone-half of a percentage points below and five5 percentage points over optimum.</p>	<p>Conduct in-place moisture-density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 200<u>250</u>001,000 cubic yards (compacted) of a single lift. The test location shall be chosen on the basis of random numbers <u>(described in Specification 12) and documented on the Lift Approval Form.</u></p> <p>a. Approve lots which meet the specified moisture and compaction.</p> <p>b. Rework and retest lots not meeting the specified moisture or compaction.</p> <p>Proctors shall be performed at a rate of one test per</p>	<p><u>Visually observe at least one in-place moisture-density test per project area. Verify that the tests are being performed at the correct frequency and that the documentation is being completed. Verify the frequency of measurements and compliance of test results. Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - CLAY LINER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
	<p>borrow lot. A borrow lot is defined as 3,000^{5,000} cubic yards (compacted) or less of a specific material type. Record the location of the Proctor sample on the "Sampling Log". <u>Document results of the proctor on the Proctor Form.</u></p>	
<p>46) PERMEABILITY: Clay liner will have an in-place permeability less than or equal to 1×10^{-6} cm/sec.</p>	<p><u>Conduct in-place permeability tests at a rate of one test per lot and record the results on the Field Permeability Test form. A lot is defined as 2,000 cubic yards of compacted clay liner. The permeability test shall be run in close proximity within five linear feet of to a moisture density test location.</u></p> <p><u>a. Approve lots which meet the specified permeability.</u></p> <p><u>b. Notify the Project Manager of lots not meeting the specified permeability to have the areas reworkedRework and retest lots not meeting the specified permeability.</u></p> <p><u>c. Retest (moisture/density and permeability) lots after rework has been completed.</u></p> <p><u>ed. Restore all test areas to assure no leaks.</u></p> <p>Permeability is verified by strict adherence to the test pad construction method and equipment. Observe compaction activities to ensure that the minimum number of passes are completed by the appropriate equipment.<u>Conduct in-place permeability tests at a rate of one test per lot and record the results on the "Field Permeability Test" form. A lot is defined as 2,000 cubic yards (compacted) of clay liner. The permeability test shall be run in close proximity to a moisture density test location:</u></p> <p>-a. Approve lots which meet the specified permeability.</p> <p>-b. Rework and retest lots not meeting the specified permeability.</p> <p>-c. Restore all test areas to assure no leaks.</p>	<p><u>Visually observe at least one in-place permeability test per project area. Verify that the tests are being performed at the correct frequency and that the documentation is being completed. Visually observe 1 lift being compacted per phase of construction every calendar year per construction season.</u>Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.</p>
<p>47) LINER DRYING PREVENTION: To prevent the clay liner from drying, water will be applied to</p>	<p>Observe the liner surface for drying. <u>Advise-Notify</u> the Project Manager <u>and notify QA</u> of any <u>desiccation</u></p>	<p>Verify that the liner is being inspected <u>correctly and the inspection documented. Report discrepancies to the</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - CLAY LINER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
the clay surface on an as needed basis or the liner will be covered with six <u>nine</u> inches of loose clay or 12-6 <u>six</u> inches of loose waste <u>compacted clay</u> . Newly constructed liner will be covered with six inches of loose clay or 12 inches of loose waste within 15 days of liner completion. Desiccation cracks larger than one-fourth inch wide and one- <u>oneh</u> three-inches deep in the clay liner will be reported to the <u>DRCDWMRC</u> and will be documented as a non-conformance item when discovered.	<u>cracks larger than one-fourth inches wide and three-inches deep in the clay liner. Retest reworked/repared areas in accordance with the compaction specification above</u> <u>Specification 45</u> . Record corrective actions taken (where required) on the " Daily Construction Report " <u>Daily Construction Report</u> .	<u>DRCDWMRC</u> as required.
48) SNOW REMOVAL: When clay liner material is to be placed and the work area is covered with snow, the snow must be removed.	Observe that snow is removed. <u>Inspect the clay liner for damage. Advise</u> Notify the Project Manager of any deficiencies/ damage and re-inspect areas after repairs are completed. Construction may not continue without taking corrective action to remove the snow. Record these corrective actions (where required) in the " Daily Construction Report " <u>Daily Construction Report</u> .	Verify that snow removal is being documented <u>and the clay liner has been inspected</u> .
49) COLD WEATHER PLACEMENT OF CLAY LINER: For purposes of this CQA/QC Manual, "frozen" is defined as a soil temperature of less than or equal to 27°F. Clay liner shall not be placed above frozen material. In addition, no frozen material shall be processed or placed. If the air temperature has dropped below 32°F since the last lift of clay liner was approved, one of the following three scenarios apply: A. (+) If less than 30 days have passed since the date of lift approval and the last lift of clay liner has been covered since the approval date with at least <u>nine</u> 9 inches of loose clay or <u>six</u> inches of compacted clay, then the cover clay may be worked with no additional testing of	As needed, observe the area where clay liner is to be placed. If frozen material is observed, cease placement of clay liner. If frozen material is suspected, measure soil temperature. Record-Document the stopping of placement in the " Daily Construction Report ". Review ambient air temperature records as measured at the site meteorological station. Document status of clay liner cover placement on the " Daily Construction Report ". Monitor-Measure the liner/foundation temperature when triggered under B.2.2.(b) of this specification, at the specified frequency. Clay temperature shall be measured between 6:00 am <u>AM</u> and 8:00 am <u>AM</u> on the day that clay liner will be placed. Temperature measurements shall include a location that is most likely to be coldest; i.e., if there is	Verify that clay liner is tested <u>as required (and the testing documented)</u> during cold weather conditions.

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - CLAY LINER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>the lower approved lift.</p> <p>B. (2)If less than 30 days have passed since the date of lift approval and the last lift of clay liner has not been covered with at least 9-nine inches of loose clay or 6-six inches of compacted clay, then:</p> <ol style="list-style-type: none"> 1. (a)Perform spring start-up testing as discussed below; or 2. (b)Monitor-Measure the liner/foundation temperature approximately one+ inch beneath the surface <u>at a frequency of one measurement per lot (defined as no more than 100,000 square feet)</u>. If the temperature 1-one inch beneath the surface is greater than 27°F, re-roll the surface with one pass of the same type of construction equipment (i.e., a compactor for intermediate lifts or a smooth drum roller for the final surface) and continue with liner construction. If the temperature 1 inch beneath the surface is less than or equal to 27°F, re-work and re-test density and permeability of the affected area after the clay temperature has risen above 27°F. <p>C. (3)If more than 30 days have passed since the date of lift approval, perform spring start-up testing.</p> <p>50) SPRING START-UP: See “Cold Weather Placement of Clay Liner”<u>Specification 49</u> above for situations that trigger this specification.</p>	<p>a portion of the liner that is shaded or at a low point. <u>To ensure a stable reading, the temperature probe shall be left in place for at least two minutes prior to taking the reading.</u>Temperature monitoring frequency shall be at least one point per 100,000 square feet or one point per contiguous project area, whichever is smaller.</p> <p>If the initial clay temperature measurement is less than or equal to 27°F, the affected area may be resampled before 8:30 am-AM the same day as follows:</p> <ol style="list-style-type: none"> a. Measure the liner/foundation temperature at a frequency of one measurement per lot (defined as no more than 10,000 square feet). b. Lots where the temperature is greater than 27°F do not require rework; except that the lot where the initial temperature less than or equal to 27°F was measured shall be reworked regardless of resampling results. 	
	Perform density <u>and Permeability</u> and permeability	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - CLAY LINER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>For spring start-up testing, the surface lift is treated as protective cover, regardless of whether it was an approved lift of clay liner at one time or not. Excavate nine⁹ inches below the clay surface and re-test for density <u>and permeability</u> and permeability. Excavation for testing purposes may consist of removing the protective cover lift; or may be performed by ‘potholing’ only at the testing locations. Areas that have been ‘potholed’ for permeability^{permeability} testing shall be repaired by applying the same level of effort as prescribed by the approved test pad for liner construction.</p>	<p>testing at the frequencies outlined for liner construction above. This testing may be performed outside of the approved lift area so long as the area tested is representative of the clay in the approved lift area (i.e., was constructed at the same time and with the same method). Moisture testing is not required for spring start-up.</p> <ol style="list-style-type: none"> Approve lots that meet specification. The protective cover lift may then be worked in place and tested to become the next lift of clay liner. For lots that do not meet specification, test the surface at successively deeper nine⁹ inch increments until a passing lift is found; remove all failing lifts^{lot}; re-work all failing areas^{lot}; and re-test. 	
<p>Spring start-up testing shall be conducted on 11e.(2) embankment lift areas S-11, R-12, L-12, H-12, and D-12 prior to and in the same construction season^{calendar year} as initial waste placement for each area.</p>	<p>Document that repairs are completed to the same level of effort as required by the approved test pad for clay liner construction.</p> <p><u>Perform spring start-up testing prior to initial waste placement on 11e.(2) Embankment lift areas S-11, R-12, L-12, H-12, and D-12.</u></p>	<p><u>Verify spring start-up testing has been completed prior to initial waste placement on 11e.(2) Embankment lift areas S-11, R-12, L-12, H-12, and D-12.</u></p>
<p>51) CONTAMINATION OF CLAY LINER: The clay liner material shall not become contaminated with radioactive soils or debris during construction. The in-place clay <u>liner material</u> may contain up to five⁵ percent additional rocks and sand above the content found in the classification test.</p>	<p><u>Prior to compaction, Visually^{visually} check the clay liner <u>material</u> for contamination by foreign materials in accordance with ASTM D2488. Remove or rework clays which have liner material that has been contaminated above the specified requirements. Document corrective actions (when required) on the Daily Construction Report.</u></p>	<p><u>Verify that the clay liner is being inspected for contaminants and that the inspection and corrective actions (if required) are properly documented. Verify that removal of contaminated material has been properly documented.</u></p>
<p>52) FINAL GRADING: Final grading shall be from grade to or above grade^{design} elevations. Survey on a 50 ft grid and key points to verify the</p>	<p>Survey the foundation on a 50 foot^{ft} grid and at key points (i.e., <u>embankment break lines</u>). Final survey measurements will be documented and provided to the</p>	<p>Review the final survey data. Verify the frequency of the survey points.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - CLAY LINER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
minimum design liner thickness requirement is met.	QC officer Lead, Embankment Construction QC and Construction QA Officer QC Supervisor and Quality Assurance. a. Indicate where the clay liner meets design line and grade. b. Rework and resurvey areas not meeting the specified grade.	
53) HEAVY EQUIPMENT ON CLAY LINER: <u>Heavy equipment travel will be minimized on top of the finished clay liner. Heavy equipment will not be operated on saturated clay liner.</u> HEAVY EQUIPMENT ON CLAY LINER: Heavy equipment travel will be minimized on top of the finished clay liner. Heavy equipment will not be operated on saturated clay liner.	Observe work on clay liner. Advise <u>Notify</u> the Project Manager of problems with equipment on the clay liner. <u>Re-inspect problem areas once corrected. Record corrective actions taken (where required) on the Daily Construction Report.</u> Observe work on clay liner. Advise the project manager of problems with equipment on the clay liner. Record corrective actions taken (where required) on the "Daily Construction Report".	<u>Verify that the work is being inspected. Verify that the work is being inspected.</u>
54) <u>DRCDWMRC</u> APPROVAL: The DRCDWMRC shall approve documentation associated with completed clay liner. Documentation shall include all QC and QA records associated with clay liner construction, as well as photographs of the completed liner surface. In addition, 48 hour notification shall be provided to the DRCDWMRC prior to placement of soil material over the clay liner (waste or soil protective cover). However, DRCDWMRC approval of clay liner documentation is not required prior to placement of waste material over the clay liner.	Notify the Construction QA Officer <u>Quality Assurance</u> that the clay liner is prepared and ready for inspection by the DRCDWMRC . Obtain written authorization on the "Liner Inspection Form" from the Construction QA Officer <u>Quality Assurance</u> that the clay liner has been inspected. <u>Obtain documentation of DRCDWMRC notification from Quality Assurance.</u>	Provide written approval of the clay liner prior to the placement of material over clay liner (waste or soil protective cover). Notify the DRCDWMRC that the clay liner is prepared and ready for inspection at least 48 hours prior to covering with soil <u>protective cover</u> material. <u>Provide QC with documentation of DRC notification.</u>
55) LINER PROTECTIVE COVER: At least <u>one+</u> ft-foot of compacted native soils, free of debris, shall be constructed on top of the clay liner. This layer is termed "Liner Protective Cover". Liner Protective Cover shall be placed in accordance with the lift thickness and compaction requirements specified under Work Element	Verify and test Liner Protective Cover in accordance with the specifications for the relevant Work Element (<u>Specifications 43 and 45 for Clay Liner Placement or Specifications 74 and 75 for Waste Placement</u>).	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - CLAY LINER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>Waste Placement or in accordance with the lift thickness and compaction requirements specified under Work Element Clay Liner Placement of Specifications 43 and 45 or Specifications 74 and 75. Contaminated equipment may be used to place Liner Protective Cover.</p>		
<p>QUALITY ASSURANCE SAMPLING: Assurance samples for clay liner materials tests are to be obtained at the following minimum frequency:</p> <ol style="list-style-type: none"> 1. In place moisture density tests (ASTM D6938): 1 per 50,000 cubic yards (compacted). 2. Moisture/density relationship testing Standard Proctor (ASTM D698): 1 per 50,000 cubic yards (compacted). 3. Classification tests (ASTM D2487, D1140, and D4318): 1 per 50,000 cubic yards (compacted). <p>A minimum of one of each of the above tests is required for each year that clay liner is placed.</p>	<p>Coordinate with QA personnel in obtaining the quality assurance samples. Record the samples on the "Sample Log" and moisture density test on the "Density Testing Log". Promptly report result of QC testing to Construction QA Officer so that a comparison of QA and QC testing results can be made.</p>	<p>Conduct or coordinate quality assurance sampling and testing in accordance with the designated frequencies. Obtain test results of QC samples so that a comparison of QA and QC test results can be made. The Construction QA Officer, in consultation with the QC officer, shall be responsible for determining the adequacy of correlation and documentation of the rationale used to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The Construction QA Officer, in consultation with the QC officer, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of the quality assurance sampling in the "Daily QA Report".</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - WASTE PLACEMENT WITH COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>56) SCOPE: This work element applies to the Class A West, and 11e.(2), and Mixed Waste embankments.</p>		
<p>57) APPLICABILITY: This work element is applicable to waste placed with the CAT 826 compactor. With prior DRCDWMRC approval, this work element may be implemented by equipment demonstrated to perform equivalent to the CAT 826 compactor.</p>	Document equipment used for compaction on the Lift Approval Form.	
<p>58) DEFINITIONS:</p> <p><u>Machine Pass</u> is defined as movement of the compactor across an area of the lift in any direction, which also meets compaction criteria calculated by an algorithm in the compactor's system. For example, movement of the compactor from south to north across the lift, which also meets compaction criteria calculated by an algorithm in the compactor's system, constitutes one machine pass; the return trip from north to south, which also meets compaction criteria calculated by an algorithm in the compactor's system, constitutes a second pass.</p> <p><u>Wheel Pass</u> is defined as movement of any of the compactor's drums across an area of the lift, which also meets compaction criteria calculated by an algorithm in the compactor's system. Since there are forward and rear drums on the CAT 826 compactor, each machine pass constitutes two wheel passes. The CAES compaction tracking system reports wheel passes.</p>		
<p>59) LINER PROTECTION: The compactor shall not be operated on the surface of finished clay liner or</p>	When disposal and compaction is being performed on or adjacent to the first lift above the Liner Protective	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - WASTE PLACEMENT WITH COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
on the surface of the Liner Protective Cover directly over the clay liner. The compactor may not be used to compact the first lift of waste above the Liner Protective Cover. When operating on a slope that terminates on the surface of the first lift of waste above the Liner Protective Cover, the compactor shall be operated in a manner to prevent impact to the Liner Protective Cover. <u>When compacting near the toe of the slope, the compactor will be operated parallel to the toe of the slope.</u>	Cover, observe compactor operation for protection of the liner and Liner Protective Cover. Document observations, <u>failures, and any corrective actions</u> on the Daily Construction Report.	
60) LIFT IDENTIFICATION: Each lift shall be given a <u>unique lift identification number</u> discrete designation.	Assign a lift identification number to each lift. Use the lift identification number to identify all paperwork for that lift. Summarize all lifts on the lift summary form or master sheet.	Verify that a <u>unique</u> lift identification number has been assigned to each lift. Verify that the lift identification number is used on all paperwork for that lift.
61) LIFT ACCEPTANCE: At the time of acceptance, the date and time of lift approval shall be recorded.	Record the date and time of lift approval on the lift-Lift approval-Approval form <u>Form</u> .	Verify that the date and time of lift approval is recorded on the lift-Lift approval-Approval form <u>Form</u> .
No waste material will be disposed on a lift until the prior lift is approved, except for management of in-cell stored waste described in Specifications 934 and 945. bulk disposal, see Work Element "Waste Disposal", Specification "In-Cell Bulk Disposal."	Verify that the previous waste lift has been approved prior to waste disposal.	
62) LIFT THICKNESS: The waste material will be placed in lifts with a compacted average thickness not exceeding 24 inches.	Survey the mean elevation of the top of each lift by surveying at least five points <u>over a 10,000 square foot area and taking the average.</u> Where practical, survey the corners and at least one spot in the middle. <u>If the average thickness of these surveys exceeds 24 inches, inform notify operation the Project Manager. The lift shall be retested surveyed with at least five more points per 10,000 square feet after it is reworked.</u> Survey measurements will be documented <u>on a survey report</u>	Perform a monthly assessment of the survey documentation performed by the QC personnel to ensure that the measurements and observations are being performed correctly. Verify that the surveys are being performed at the correct frequency and that the documentation is being completed. Verify that the survey data has been received from the QC personnel.

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - WASTE PLACEMENT WITH COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
	<p>and forwarded to the Construction QA Officer<u>Quality Assurance</u>. Lift thickness may also be verified via GPS.</p> <ol style="list-style-type: none"> Approve lifts with an average less than or equal to the specified lift thickness. Remove excess material from the thicker areas of the lift if the average lift thickness is greater than 24 inches, and re-compact lift in the areas where wastes are removed. 	
	<u>- OR -</u>	
	<p>Download the CAES system report of beginning and ending lift elevations. For lifts that are not sloped, survey data may be used for beginning lift elevation. Lift thickness shall be reported using CAES in accordance with <u>current</u> operating procedures CL QC PR-038. When calculating the average lift thickness on a side slope, no point shall be more than 2.1 <u>feet</u>². If CAES is used to document lift thickness on the side slope, there shall be no white pixels shown in the lift. <u>CAES data may be supplemented by GPS for areas where compactor coverage is inconclusive.</u></p>	
63) LIFT AREA: Identify the dimensions and the location of the northwest corner of the lift. There is no minimum lift area for this work element.	Locate the northwest corner of each lift, and document the location and lift dimensions.	
64) CLASSIFICATIONS: Soil classification testing is not required for waste placed using this work element.		
65) TERRACING OF LIFTS: <u>Lifts constructed at times more than 30 days apart from each other shall have</u> As new lifts are placed next to old lifts, at least one foot, measured horizontally, shall be removed from the outer edge of the old lift (except	<p>Inspect the intersections of old and new lifts. Verify that the outer one foot of the old lifts are being removed (except for CLSM lifts). Record any problems <u>and corrective actions taken</u> on the "Daily Construction Report"<u>Daily Construction Report</u>.</p>	Verify that the required inspections are being performed <u>and documented</u> .

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - WASTE PLACEMENT WITH COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
for CLSM lifts). <u>For compaction adjacent to CLSM surfaces, lift compaction will be conducted as close to the CLSM as the compactor can achieve.</u>		
<p>66) COMPACTION WITH CAES: When using the CAES system, each lift and lift interface shall be compacted by at least <u>four</u> machine passes with the CAT 826 compactor. The lift surface shall be firm and unyielding to the compactor's weight. A minimum of 90 <u>percent</u> of the grid points reported for the lift by CAES shall exhibit adequate compaction and machine passes. Adequate compaction as well as meeting the minimum number of wheel passes is reported by CAES when the pixel turns green. Furthermore, a maximum of <u>five</u> non-green pixels shall be adjacent to each other within the lift area limits. "Adjacent" means that two pixels share a common side; pixels that share only a common corner are not adjacent to each other.</p> <p>A. Additional compaction may be required if, after the minimum number of passes is complete, the minimum percentage of grid points do not exhibit adequate compaction, as reported by the CAES system.</p> <p>B. Evaluate the lift interface when compacting adjacent to previously poured CSLM. Visually inspect for obstructions (e.g., CLSM surface, irregularities in CLSM side slope, etc.) that may affect compaction data. More than <u>five</u> non-green adjacent pixels are permitted in this situation if QC visually observes and documents a minimum of <u>six</u> machine passes to within 12 inches of the obstruction.</p>	<p>Document the CAES system report of compaction for each lift area. Compactive effort is reported by CAES on a roughly 3.3' x 3.3' grid; with each on-screen pixel representing one square meter. Ensure that the CAES reports a minimum of <u>four</u> machine passes (i.e., 8 wheel passes) for at least 90 <u>percent</u> of the grid points in the lift, as detailed in operating procedure CL-QC-PR-038. Record this information on the Lift Approval Form. Perform a QC inspection of the compacted lift by observing the CAES control screen for evidence of uniform and adequate compaction. This condition is indicated by having <u>a minimum of 90 percent</u> a majority of the screen light green, with only isolated pixels in other colors. Evaluate all pixels that are not green to ensure the maximum number of adjacent pixels is not exceeded. Print the screen as a color image and <u>include with the Lift Approval Form</u>. include with the lift approval form document Record QC inspection results on the Lift Approval Form.</p> <p>Perform a visual inspection of the CLSM/Soil interface. Identify areas of the CLSM pour that present an obstacle for the 826 compactor. Visually observe the compactor operator make a minimum of <u>six</u> machine passes to within 12 inches of the obstruction. Document the observations on the Lift Approval form.</p>	<p>Perform a monthly assessment of the compaction documents generated by the QC technician.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - WASTE PLACEMENT WITH COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>67) COMPACTION WITHOUT CAES: If the CAES system is not available to be used for compaction under this work element, the following requirements apply.</p> <p>A. Verbal notice shall be provided to DRCDWMRC within 24 hours of beginning to approve lifts without CAES. This notice may be provided via email.</p> <p>B. Written notice shall be provided to DRCDWMRC no later than three3 calendar days (72 hours) after beginning to approve lifts without CAES. The written notice shall explain why CAES is down; an estimate of when CAES will be back online; a map of the areas being compacted without CAES; and a map of pre-final-cover-interim settlement monitoring pointsmonuments over the area being compacted without CAES.</p> <p>C. Compaction without CAES is limited to 10 calendar days per occurrence.</p> <p>D. Each lift and lift interface shall be compacted by at least six6 machine passes with the CAT 826 compactor. The lift surface shall be firm and unyielding to the compactor's weight. Additional compaction may be required if, after the minimum number of passes is complete, any of the following are observed:</p> <p>1. The lift surface exhibits ruts or compression (excluding depressions caused by the tines of the compactor wheel) in excess of four inches;</p>	<p>Document that the minimum number of passes is completed for each lift area. Passes shall be counted by the QC technician or by using a GPS unit communicating with the GPS unit on the compactor.</p> <p>Perform a visual inspection of the compacted lift surface. If rutting or other indications of inadequate compaction are present, direct the equipment operator to complete additional passes until the situation is corrected. If additional passes are unable to correct the</p>	<p><u>Notify DWMRC within 24 hours of beginning to approve lifts without CAES. Provide QC with documentation of DRC notification.</u></p> <p><u>Provide written notice to DWMRC no later than three calendar days after beginning to approve lifts without CAES. Provide QC with a documentation of written DRC notification. Note: Verbal and written notification may be submitted by the Engineering Manager, or designee, and then provided to Quality Assurance.</u></p> <p>Perform a monthly assessment of<u>Review</u> the compaction documents generated by the QC technician.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - WASTE PLACEMENT WITH COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>2. The waste material exhibits pumping behavior, or has other indications of excess moisture content; or</p> <p>3. The lift does not appear to be uniformly compacted.</p>	<p>situation, moisture adjustment or other corrective actions may be needed and the lift shall not be approved until these actions are completed. <u>Record any problems and corrective actions taken on the Daily Construction Report.</u></p> <p>Survey lift elevation and thickness in accordance with Specification 62<u>the specification “Lift Thickness” above</u>, with the further requirement that the greater of the following number of points shall be surveyed per lift:</p> <p>a. At least five<u>5</u> points; or</p> <p>b. One point per 2,000 square feet of lift area.</p> <p>Record the number of passes and visual inspection results on the Lift Approval Form.</p>	
<p><u>68) DEBRIS PLACEMENT WITH THE COMPACTOR:</u> For purposes of this work element, debris <u>is defined in Specification 78 with the exception that a large object is defined as incompressible debris exceeding the debris size requirements of Specification 69, shall be defined as provided in the work element “Waste Placement”, below.</u></p> <p>Debris placed in accordance with this work element shall be limited to no more than 50 percent<u>%</u> by volume of the compacted volume of the lift. The debris shall be uniformly distributed across the lift.</p> <p>Lifts containing materials susceptible to wind dispersal shall be covered with soil-like waste, fill</p>	<p>Determine the volume of debris. Volume determination shall be established by either:</p> <p>a. inspecting the debris on the lift and calculating the quantity-volume of debris, or</p> <p>b. using the manifested waste volume for shipments placed on the lift.</p> <p>Inspect debris once it is spread out on the lift and prior to placement of fill material. Ensure that debris is spread out uniformly across the lift and in a manner to minimize void spaces and does not exceed volume requirements. Document the debris inspection <u>and debris percentage calculations</u> on the Lift Approval Form.</p> <p>Record the debris fill calculations and estimates on the Lift Approval Form.</p> <p>Document cover material used, location, and result of visual inspection to ensure materials are secure on the “Daily Construction Report”<u>Daily Construction Report</u>.</p>	<p>Observe in the field that the debris calculations and estimates are being performed and properly documented. Review documentation to verify that the visual observations of debris shipments are being properly performed by QC personnel or that the manifested volume of waste is used to calculate the volume of fill material required.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - WASTE PLACEMENT WITH COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
material, or a commercial fixative so that these materials are secured by the end of the shift the materials were placed into the lift. "Secure" means a visual inspection to confirm that cover material has been applied to all materials susceptible to wind dispersal so that no material is obviously blowing around. Plastic, etc., may be visible at the surface.		
69) DEBRIS SIZE: All <u>incompressible</u> debris placed in accordance with this work element shall be less than 40-18 <u>16</u> inches in at least one dimension and no longer than 12 feet in any dimension. <u>Note: bags of asbestos containing debris may be larger than 10-18 inches in all dimensions before compaction.</u>	Inspect debris placed in soil lifts to ensure that it meets the debris size requirements. <u>Record the results in the Daily Construction Report.</u>	
70) SNOW REMOVAL: When waste material is to be placed and the work area is covered with snow and/or ice, the snow and/or ice must be removed so that no more than 1/4 <u>one quarter</u> inch remains on the surface. Isolated individual clumps of snow and/or ice may be present, but shall be no larger than 2 <u>two</u> inches in diameter.	Observe that snow is removed. <u>Inspect the waste lift for damage. Advise-Notify</u> the Project Manager of deficiencies/ <u>damage</u> . Construction may not continue without corrective action <u>and re-inspection of deficiencies/damage</u> . Record corrective action (where required) in the "Daily Construction Report" <u>Daily Construction Report</u> .	Verify that snow removal is being performed and documented <u>and the waste lift has been inspected.</u>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
71) SCOPE: This work element applies to the Class A West, and 11e.(2), <u>and Mixed Waste</u> embankments.		
72) LIFT IDENTIFICATION: Each lift shall be given a discrete-unique designation for testing and surveying purposes.	Assign a lift identification number to each lift. Use the lift identification number to identify all paper work for that lift.	Verify that a <u>unique</u> lift identification number has been assigned to each lift. Verify that the lift identification number is used on all paper work for that lift.
73) LIFT ACCEPTANCE: At the time of acceptance, the date and time of lift approval shall be recorded.	The QC technician shall record the date and time of lift approval on the <u>Lift Approval Form</u> .	Verify that the date and time of lift approval is recorded on the <u>Lift Approval Form</u> .
No waste material will be disposed on a lift until the prior lift is approved, except for <u>stored waste described in Specification 934 and 945</u> . management of in-cell bulk disposal, see Work Element "Waste Disposal", Specification "In-Cell Bulk Disposal".	Verify that the previous waste lift has been approved prior to waste disposal.	
74) LIFT THICKNESS: The radioactive disposal-waste material will be placed in lifts with a compacted average thickness not exceeding 12 inches (except CLSM lifts).	Survey the mean elevation of the top of each lift by surveying at least five points <u>over a 10,000 square foot area</u> and taking the average . Where practical, survey the corners and at least one spot in the middle. <u>If the average thickness of these surveys exceeds 12 inches, advise the Project Manager to have operations rework the lift. The lift shall be retested-surveyed with at least five more points per 10,000 square feet after it is reworked.</u> Survey measurements will be documented and forwarded to the Construction QA Officer . <u>Quality Assurance</u> . a. Approve lifts with an average less than or equal to the specified lift thickness. b. Remove excess material and retest lots with an average lift thickness greater than the specified lift thickness.	<u>Verify the frequency of measurements and compliance of test results. Observe, at a minimum, five percent of the surveys performed by the QC personnel to ensure that the measurements and observations are being performed correctly. Verify that the surveys are being performed at the correct frequency and that the documentation is being completed.</u> Verify that the survey data has been received from the QC personnel.

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>LIFT AREA: The lift area shall be at least 10,000 square feet except CLSM, Containerized Waste Facility, and Mixed Waste lifts. Identify the dimensions and the location of the northwest corner of the lift.</p>	<p>Locate the northwest corner of each active lift, and determine the dimension.</p> <p>a. Allow placement to continue on any lift that meets the lift area requirement.</p> <p>b. Stop placement on any lift which does not meet the lift area requirements.</p> <p>c. The Construction QA Officer may grant a waiver, for up to five percent of the lifts, if it is deemed impracticable to place at the specified lift area (e.g. a narrow lift on the outside edge of the cell). Insufficient material from a specific generator does not constitute grounds for a waiver.</p>	<p>Verify that the lift area meets the lift area requirements.</p>
<p>75) COMPACTION: Each lift shall be compacted to 90 percent of a standard Proctor, except lifts with greater than ten (10%) <u>percent</u> compressible debris, which shall be compacted to a minimum of 95 percent of a standard Proctor.</p> <p>The moisture content of all lifts shall be equal to at least <u>2-two</u> percent and no greater than up to <u>3-three</u> percentage points above the optimum moisture (except for CLSM lifts).</p>	<p><u>Proctors shall be performed at a rate of one test per 15,000 cubic yards (compacted) or less of a specific material type.</u></p> <p>Except for CLSM lifts, conduct in-place moisture-density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 1,000 cubic yards (compacted) of a single lift. At least one test will be performed per lift. At least one test will be performed per soil type in the lift. The test location shall be chosen on the basis of random numbers <u>(described in Specification 12) and will be documented on the Lift Approval Form.</u> Approve lots <u>for compaction criteria</u> where:</p> <p>a. <u>Material—material</u> is observed to be properly compacted <u>throughout across the surface of</u> the lot; <u>and</u></p> <p>b. <u>m</u>Moisture/density tests <u>performed—results</u> meet moisture and compaction specifications.</p> <p><u>Outliers shall be resolved according to the following:</u></p> <p>a. For lot sections where the material is observed to</p>	<p><u>Verify the frequency of measurements and compliance of test results.</u> Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that field moisture/density tests are being performed at the correct frequency and that the documentation is being completed.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
	<p>not be properly compacted throughout the entire lot:</p> <p>1) Identify the section requiring further compaction and rework the material until it is observed to be adequately compacted;</p> <p>2) Perform moisture/density testing as outlined above.</p> <p>b) For lots where the dry density reading from a nuclear gauge moisture/density test is less than or equal to the required percentage of the standard Proctor <u>and/or moisture content is less than two percent or greater than three percentage points above optimum moisture:</u></p> <p>1)a. Identify the section(s) of the lot(s) (including dimensions) requiring further compaction, and re-work the material. Re-test at the location previously tested. Test one more location in <u>each</u> the re-worked lotsection. Identify the test location using the lotsection dimensions and random numbers <u>(described in Specification 12)</u>.</p> <p>1) If the test results from both tests meet moisture/density requirements, approve the lot;</p> <p>2) If either test fails, repeat the above process until all tests at both locations meet moisture and compaction requirements.</p> <p style="text-align: center;">- OR -</p> <p>b.2) If the lot is observed by the QC Technician to be adequately compacted, investigate the reason for the low density reading. If it is determined that the test results were <u>improperly influenced</u> (e.g. debris directly</p>	<p>Ensure that resolution of any outliers-reworked lots <u>are</u>s properly accomplished and documented.</p> <p>Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that proctor tests are being performed at the correct frequency for each specific material type and that the documentation is being completed properly.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
	<p>beneath the gauge), take two more density tests within five5 feet of the original test. Note: All tests are to be recorded <u>on a Field Density Test form</u>.</p> <p>± If the results from both tests are above the required compactionmeet moisture/density requirements, record both tests and approve the lot.</p> <p>If either test fails to meet moisture/density specifications – and the test results were not improperly influenced as described above - follow instructions for a 2+ above. Proctors shall be performed at a rate of one test per 15,000 cubic yards (compacted) or less of a specific material type.</p>	
76) CLASSIFICATIONS: One soil classification test shall be performed at six month intervals for each large soil waste generator.	Perform a soil classification test (ASTM D2487) every six months for each large soil waste generator. <u>Perform this test at a random location as described in Specification 12 from the soil waste generator.</u> A large soil waste generator is defined as a generator disposing of at least 30,000 cubic yards (compacted) of compactable soil in a given calendar year. Record the location of the classification sample on the "Sampling Log".	Verify the <u>sampling frequency</u> is met of laboratory tests.
77) TERRACING OF LIFTS: As new lifts are placed next to old lifts, Lifts constructed at time more than 30 days apart from each other shall have at least three feet, measured horizontally, shall be removed from the outer edge of the old lift (except for CLSM lifts). <u>For lifts that interface with CLSM; in addition to the moisture-density testing of the lift, one</u>	Inspect the intersections of old and new lifts. Verify that the outer three feet of the old lifts are being removed (except for CLSM lifts). <u>Document inspections on the Lift Approval Form.</u> Record any problems on the "Daily Construction Report" <u>Daily Construction Report.</u> <u>For lifts that interface with CLSM: Perform the moisture-density test in within four feet of the CLSM</u>	Verify that the required inspections are being performed <u>and documented.</u> <u>Verify the frequency of measurements and compliance of test results.</u>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
moisture-density test shall be performed to verify requirements are met at the CLSM/soil interface. This CLSM/soil interface density test shall be performed within four feet of the CLSM/soil interface.	<u>interface. Moisture-density testing and corrective actions, when required, shall be performed and documented in accordance with Specification 75 with the exception that an interface moisture-density test is not required for each soil type.</u>	
INTERSECTION OF LIFTS: In addition to the density testing of the lift, an average of one density test per three lifts shall be performed at the old/new lift interfaces. For lifts intersecting with CLSM lifts, the interface density testing is performed on the non-CLSM lift within 2 feet of the CLSM interface.	Conduct in place moisture density tests at an average rate of one test per three lifts and record the results on the "Field Density Test" form. For each lift random numbers between 0 and 1 shall be generated. If the random number is 0.65 or greater, then a moisture density test is required on the lift interface between the new lift and old lift. On lifts requiring an interface test, the test location shall be chosen on the basis of a random number. For intersections with CLSM, perform a density test on the non CLSM portions of the intersection within 2 feet of the CLSM interface. a. Approve lots which meet the specified compaction. b. Rework and retest lots not meeting the specified compaction.	Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests are being performed correctly. Verify that tests are performed at the correct frequency and the documentation has been completed.
DEBRIS PLACEMENT <u>(Specifications 78 thru 813)</u>		
78) DEBRIS DEFINITION: For the purposes of this CQA/QC <u>project plan manual</u> , debris is defined as any radioactive waste for disposal other than compactable soils. Compactable soil is defined as: <u>A.(a)</u> having a graded material that will pass through a four inch grizzly; <u>B.(b)</u> as having a bulk density greater than seventy pounds per cubic foot dry weight in accordance with ASTM D698; and <u>C.(c)</u> having soil-like properties (i.e., standard tests in accordance with waste	No action required.	No action required.

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>placement procedures can be performed.</p> <p>Additionally, debris shall be classified as either incompressible debris (i.e. concrete, stone, or solid metal) or compressible debris (all other debris types). A large object is defined as <u>any incompressible debris that does not have at least one dimension less than 10 inches or that has any dimension in excess of 12 feet exceeding the debris size requirement of Specification 82</u>. A large component is defined as a large object that weighs more than 100,000 pounds.</p> <p>79) DEBRIS PLACEMENT METHODS: Debris may be placed in the embankment using two different methods:</p> <p><u>A.1)</u> placement of the debris in a lift with compactable soil at a limited ratio of debris to soil <u>as defined in Specification 80</u>; or</p> <p><u>B.2)</u> placement of the debris in a lift and in-filling the debris with Controlled Low Strength Material (CLSM).</p> <p>For placement of large components, the maximum allowable load on the clay liner surface must be less than <u>3,000</u> psf.</p> <p>When CLSM is required as structural fill in the Large Component Engineering Review in order to meet the load specification, the first 4 feet of CLSM shall be placed around the large component within 30 calendar days of large component disposal.</p>	<p><u>Have the Engineering Manager p</u>Perform a Large Component Engineering Review. Ensure that the bearing pressure at the clay liner surface meets specification for the load associated with placement of any large component.</p> <p>Document the <u>date of large component disposal and the date of the CLSM pour following on</u> and include with the Lift Approval Form.:</p> <p><u>1. Date of large component disposal and date of CLSM pour.</u></p>	<p><u>If CLSM is required to meet the load specification requirement, verify the first <u>four</u>4 feet of CLSM was placed around the large component within 30 calendar days of large component disposal.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>3-80) DEBRIS QUANTITY IN SOIL WASTE LIFTS: Debris that is placed in an<u>the</u> embankment with compactable soil shall be limited to a portion<u>percentage</u> of the total volume of the waste lift, or portion of the lift designated for debris placement<u>ot</u>. Furthermore, the debris shall be uniformly distributed across the lift, or portion of the lift designated for debris placement<u>ot</u>.</p> <p>Lifts containing materials susceptible to wind dispersal shall be covered with soil like waste, fill material, or a commercial fixative so that these materials susceptible to wind dispersal are secured by the end of each working day. are secured by the end of the shift the materials were placed into the lift. "Secure" means a visual inspection to confirm that cover material has been applied to all materials susceptible to wind dispersal so that no material is obviously blowing around. Plastic, etc., may be visible at the surface.</p> <p>A lot is defined as an area for the placement of waste from a single generator. The volume of a lot is limited to one thousand (1000) cubic yards for testing purposes. A lift is defined as one or more lots which are compacted and tested together to meet lift placement requirements. The minimum fill required will be controlled by the volume of uncompacted debris placed in the lift.</p> <p>For compressible debris, the volume of the debris in a <u>lift, or portion of the lift designated for debris placement</u> ot shall be limited to less than or equal to thirty percent (30 percent%) by volume of the calculated compacted volume of the <u>lift, or portion of the lift designated for debris placement</u>ot.</p>	<p>For shipments containing debris material, determine the volume of debris for the shipments. Volume determination shall be established by either<u>either</u>:</p> <ol style="list-style-type: none"> inspecting the debris in the shipment and calculating the volume<u>quantity</u> of debris;<u>;</u> or using the manifested waste volume. <p>Visually inspect<u>Perform a visual inspection to verify that lifts containing materials susceptible to wind dispersal are covered with soil like waste or fill material or a commercial fixative by the end of each working daythe shift the materials were placed into the lift. Document the inspection and any corrective actions on the Daily Construction Report.</u></p> <p>Inspect debris once it is spread out on the <u>lift, or portion of the lift designated for debris placement</u>ot and prior to placement of fill material. Ensure that debris is spread out uniformly across the <u>lift, or portion of the lift designated for debris placement</u>ot and in a manner to minimize void spaces and does not exceed volume requirements. Document the debris inspection and <u>debris percentage calculations</u> on the "Lift Approval Form."Record the debris fill calculations and estimates on the "Lift Approval Form".</p>	<p>Observe in the field that the debris calculations and estimates are being performed and properly documented.</p> <p>Review documentation to verify that the visual observations of debris shipments are being properly performed by QC personnel or that the manifested volume of waste is used to calculate the volume of fill material required.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>Incompressible debris (concrete, stone, or solid metal) may be placed in a <u>lift, or portion of the lift designated for debris placement</u>† up to twenty-five<u>25</u> percent by volume of the calculated compacted volume of the <u>lift, or portion of the lift designated for debris placement</u>†. When combining the two types of debris in one <u>lift, or portion of the lift designated for debris placement</u>†, the above volume limit applies and the maximum volume of all debris shall be less than or equal to 25 percent.</p> <p>At least one moisture/density test shall be performed per soil type in the lift.</p>		
<p>81) WIND DISPERSIBLE DEBRIS: Lifts containing materials susceptible to wind dispersal shall be covered with soil-like waste fill material or a commercial fixative so that these materials are secured by the end of the shift the materials were placed into the lift. “Secure” means a visual inspection to confirm that cover material has been applied to all materials susceptible to wind dispersal so that no material is obviously blowing around (however, “secure” material may potentially be dislodged, but is required to remain within the restricted area of the facility). Plastic, etc., may be visible at the surface.</p>	<p>Perform a visual inspection to verify that lifts containing materials susceptible to wind dispersal are covered with soil-like waste fill material or a commercial fixative by the end of the shift the materials were placed into the lift. Document the inspection and any corrective actions on the <u>Daily Construction Report</u>.</p>	<p><u>Review documentation to verify that the visual observations of debris shipments are being properly performed by QC personnel.</u></p>
<p>82) DEBRIS SIZE: All Incompressible debris placed in soil waste lifts shall be less than ten (10) inches in at least one dimension, and no longer than twelve (12) feet in any dimension. Note: bags of asbestos containing debris may be larger than 10 inches in all dimensions before compaction.</p>	<p>Inspect debris placed in soil lifts to ensure that it meets the debris size requirements. <u>Document on the Daily Construction Report.</u></p>	<p>Review documentation associated with debris lifts to verify that debris inspections are being performed.</p>
<p>83) RESIN LIFTS: Unless disposed in the Containerized Waste Facility, resins shall be</p>		

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>disposed as follows or in accordance with the specification—Specification 8990, “CLSM Pours with Resin Filled Containers” below. For resin lifts, resins will be less than one inch thick, at any location on the surface of the lift, prior to tilling.</p> <p><u>A blending layer of native soil shall be spread across a lift prior to placement of the resin. For Exchange Resin (IER) must be blended with native clay that meets theThe blending layer material shall be defined as CL based on the Unified Soil classification Classification system in a minimum ratio of 1:9 (one part IER to nine parts CL clay) on a volumetric basis. This native clay shall be tested by ASTM method D 2487 at a rate of one test every 250 cubic yards.</u></p> <p><u>Prior to spreading resins across the blending layer, there shall be no depressions or wheel ruts deeper than one inch.</u></p> <p>Blending of IER must take place where native soil has been placed and approved by the Construction Quality Control Officer (CQCO) QC Supervisor as a marker layer over the previous lift. The CQCO QC Supervisor may approve the 6 inch fill cover for the 10% debris lifts as the bottom marker layer provided verification of the following: that <u>10% debris is placed in previous lifts; and cover fill is native soil that is distinguishable from the previous lift and resin clay</u> <u>Resins are limited to a maximum of 10 percent, by volume, of the blending layer of lift. Prior to blending resins shall</u></p>	<p><u>Perform laboratory classification tests (ASTM D2487) on native soil at a rate of one test per lot prior to placement of resins. A lot is defined as a maximum of 250 cubic yards (compacted) of specified material type. Record the location of the classification sample on the Sample Log.</u></p> <p><u>Prior to placement of resins, survey the blending layer and inspect the surface for depressions and wheel ruts. Include the survey report with the Lift Approval Form. Document inspection results, discrepancies identified, and corrective actions taken on the Lift Approval form.</u></p> <p>For resin lifts, inspect <u>Inspect</u> the spread resin prior to tilling to ensure:</p> <ol style="list-style-type: none"> <u>resin is less than one inch thick at any location on the surface of the lift and is proportioned at a maximum of 10 percent, by volume, of the compacted lift;</u> <u>resin is spread throughout the resin lift area;</u> <u>there are no areas larger than 25 ft²-square feet without resin;</u> there are no depressions or wheel ruts deeper than one inch. verify native clay meets CL classification and is blended at a 9 to 1 ratio. Verify a minimum of 2 inches of native soil cover must be placed by the end of each workday. <p><u>Require additional spreading for any resin lift not meeting these specifications. Record the debris inspection on the Lift Approval Form.</u></p> <p><u>Verify resins have been thoroughly blended with the</u></p>	<p>Review documentation associated with resin lifts to verify blending and disposal requirements are being performed.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p><u>be evenly spread across the lift with no areas larger than 25 square feet without resins and resins shall be less than one inch thick at any location.</u></p> <p>Exposed blended rResins shall be compacted, tested and approved after placement of at leastthoroughly blended with the blending layer and covered with a minimum of 2two inches of native soil coverclay prior to compacting. The total lift thickness (blending layer plus the clay cover) shall be limited to one foot. The clay cover must be placed by the end of each work day. <u>The approved cover</u>and may be used as part of the blending layer for the next resin lift. A minimum of 2 inches of native soil cover must be placed by the end of each workday. The minimum 2 inch native soil cover may be used to blend the resin in the next lift.</p> <p><u>The DWMRC shall be notified at least 48 hours in advance of the placement of blended materials beyond this two inch clay layer.</u></p>	<p><u>blending layer prior to placement of clay cover. Verify that a minimum of two inches of clay cover has been placed by the end of each workday and document on the Daily Construction Report. Perform moisture and density testing in accordance with Specification 75.</u>Notify DRC during normal working hours of placement of blended materials at least 24 hours prior to covering beyond this 2" clay layer in order to allow inspection and sampling of placed blended materials.</p> <p><u>Obtain documentation of DWMRC notification.</u></p>	<p><u>Notify the DWMRC at least 48 hours in advance of the placement of blended materials beyond the two inch clay layer. Provide QC with documentation of DWMRC notification.</u></p>

CLSM POURS (Specifications 834 thru 923):

84) CLSM PYRAMID:

- A. ~~1)~~CLSM lifts shall form a pyramid with a final maximum 3H:1V outside edge slope. Thus, with a six foot CLSM lift and six inch ~~(6")~~cap, the next CLSM ~~lift~~tier must be constructed to minimum of 19.5 feet inside the

Determine the location of the northwest corner and the dimensions of each lift and document on the ~~ES-1904 form~~Lift Approval Form. Use the lift location and dimensions to ensure compliance with this specification~~the CLSM pyramid specification.~~

Verify compliance with this ~~CLSM~~ pyramid specification and proper documentation of the QC requirements.

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>edge of the lift immediately below it.</p> <p><u>B.</u> The pyramid base dimensions and maximum 3H:1V side slope requirements will control the location of all subsequent CLSM lifts throughout the full height of the embankment.</p> <p>A-C. Adjacent pyramids shall not be placed above any portion of previous CLSM pyramids.</p>	<p>Document the dimensions of the previous CLSM lift on the <u>Lift Approval Form</u>ES-1904 form diagram. In locating a new pyramid, document on the <u>Lift Approval Form</u>ES-1904 form:</p> <ol style="list-style-type: none"> The pyramid base is placed on the Liner Protective Cover; or, The pyramid base has not been placed above a previously placed pyramid. 	
<p>CLSM Lift Preparation: The average height of each pour shall be limited to six feet or less. Large objects taller than six feet shall be poured with the subsequent CLSM pours (in layers) until completion. <u>The height restriction does not include the six inch cap, if applicable, or CLSM used for repairs in accordance with Specification 92a.</u></p>	<p>Perform an inspection of the preparation of debris for placement with CLSM. Ensure that the average formed height of the CLSM lift is less than six feet and that any large objects are localized into specific areas.</p> <p>Also,</p>	<p>Review inspection documentation to verify<u>ensure</u> that inspections are performed and properly documented.</p>
<p>Debris disposed with CLSM will be placed to minimize the entrapment of air in the CLSM pour.</p>	<p>Eensure that debris is placed in a manner to minimize the possible entrapment of air during the CLSM pour and to allow maximum in-filling of the debris. Document the inspection on the CLSM Inspection Form.</p>	
<p><u>85) DRCDWMRC NOTIFICATION FOR CLSM POURS:</u> The DRCDWMRC shall be notified at least 48 hours in advance of any CLSM pour. A CLSM pour will be defined as a formed area approved and documented by QC<u>the Engineering Manager</u> for CLSM designated on a waste lift.</p>	<p>Verify thatObtain documentation of the DRCDWMRC notification. has been notified at least 48 hours in advance of any CLSM pour. Document DRC notification on the "Daily Construction Report".</p>	<p>NotifyVerify that the DRCDWMRC has been notified at least 48 hours in advance of any CLSM pour. <u>Provide QC with documentation of DRCDWMRC notification.</u></p>
<p><u>86) PORTLAND CEMENT OR FLY ASH CLSM DESIGN SPECIFICATIONS:</u></p> <p>Notwithstanding the following specifications,</p>		

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
Macro Vaults as approved by the Division of Solid and Hazardous Waste DWMRC in the Mixed Waste Landfill Cell are considered large objects that do not require CLSM. Macro Vaults shall not be proof-rolled.		
CLSM shall have the following characteristics:		
<p>A. a)The design mix is approved by the production engineerManager, Engineering and MaintenanceEngineering Manager prior to use in the cell area and meets the material specifications provided in Table 2 “Material Specifications for Portland Cement CLSM”.or Table 3 of this Attachment II AManual.b)</p> <p>B. The CLSM passes a Slump Test (procedure provided in Appendix B of this Manual)(ASTM C143), Flow Consistency Test (ASTM D6103) or Efflux test (procedure provided in Appendix B of this <u>Manual</u>), as applicable. Passing criteria for each test is specified in Table 2 “Material Specifications for Portland Cement CLSM”.</p>	<p>Two types of tests will be performed to ensure that the CLSM meets the design specifications: initial screening tests and lot acceptance tests. The results of these tests and corrective actions, if any, shall be documented on the CLSM Testing Form.</p> <p>a. Initial screening tests shall be performed on the first load of CLSM for each day that CLSM is poured. This screening test shall be performed from the “front end” of the load. The initial screening test includes either a Flow Consistency Test (ASTM D6103) or Efflux test (procedure given in Appendix A), as well as a unit weight test (ASTM D6023). The results from this initial screening test shall indicate whether or not any adjustments need to be made at the batch plant to ensure loads meet design specifications.</p> <p>b. If adjustments are made to the load to produce a product that passes the testing requirements, perform initial screening testing on the subsequent two loads to verify that the batch plant adjustments are sufficient</p> <p>c. CLSM pouring shall only be authorized to proceed upon verification that the initial load (and subsequent two loads if the initial load failed) meets mix specifications.</p> <p>d. Acceptance tests shall be performed at a rate of one test per lot, with a minimum of one acceptance test</p>	<p><u>Verify the frequency of measurements and compliance of test results.</u>Observe, at a minimum, five percent of the tests performed by QC personnel on the CLSM to ensure that the tests and observations are being performed correctly. Verify that the required testing has been performed and properly documented.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
	<p>performed for each CLSM pour. A lot is defined as 100 cubic yards of CLSM. Sampling for acceptance tests shall be performed in accordance with ASTM D5971 (<u>“Practice for Sampling Freshly Mixed CLSM”</u>). These acceptance tests shall be performed from a composite of two samples from near the middle of the load.</p> <p>a1) Accept loads that meet specification.</p> <p><u>2)b.</u> For loads with unsatisfactory results, accept the first part of the load and reject the remainder, or modify the load and/or pour techniques and retest.</p>	
<p>A. or Table 3 “Material Specifications for Fly Ash CLSM” of this Attachment II A.</p> <p>e) The CLSM shall have a wet unit weight in all cases of at least 100 lbs/ft³ as determined by ASTM D6023 (Unit Weight, Yield, Cement Content, and Air Content (Gravimetric) of CLSM).</p> <p><u>C.e)</u> The CLSM shall have a minimum 28-day strength of 150 pounds per square inch (psi) as determined by ASTM D4832. A minimum of <u>three</u>3 cylinders shall be cast for compressive strength testing.</p>	<p>Cast a minimum of <u>three</u>3 cylinders per 2,000 cubic yards of CLSM placed, with at least one set per lift for lifts smaller than 2,000 cubic yards. Perform compressive strength testing in accordance with ASTM D4832 at 28 days to ensure the minimum strength requirements are met. <u>This test may be performed in-house or sent off-site to an AMRL certified laboratory.</u> If the CLSM map does not meet specification, evaluate why it failed and implement corrective actions to prevent recurrence. <u>Record the reason for the failure and the corrective action on the Lift Approval Form.</u></p> <p><u>Conduct a unit weight test (ASTM D6023) in conjunction with sampling for compressive strength testing of Specification 86.C.</u></p>	<p><u>Verify</u>Ensure compressive strength testing is being performed at the correct frequency.</p>
<p><u>E. The CLSM shall have a wet unit weight in all cases of at least 100 lbs/ft³ as determined by</u></p>	<p>Obtain the load ticket for each truck load of CLSM and ensure the load meets the mix specifications provided in Table 2 “Material Specifications for Portland Cement CLSM” or Table 3 “Material Specifications for Fly Ash CLSM” of this Attachment II A Manual.</p>	<p><u>Verify unit weight testing is being performed at the correct frequency.</u></p> <p>Verify that the load tickets have been obtained by QC personnel for each truck load of CLSM and that the</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>ASTM D6023 “Standard Test Method for Density (Unit Weight), Yield, Cement Content, and Air Content (Gravimetric) of Controlled Low-Strength Material (CLSM)”.</p> <p><u>D.e)</u>A load ticket shall be furnished for each truck of CLSM to be poured.</p>	<p>Reject any loads not meeting the mix specifications. Include the load ticket with the Lift Approval Form for the CLSM lift. During each CLSM pour, a QC Technician shall be present at or near the pour at all times and shall visually observe pour activities. <u>Document discrepancies on the Daily Construction Report.</u></p>	<p>load ticket has been checked against Table 2 “Material Specifications for Portland Cement CLSM” or Table 3 “Material Specifications for Fly Ash CLSM”.</p>
<p>87) CLSM PLACEMENT OF UNCONTAINERIZED DEBRIS: Debris shall be placed to minimize the entrapment of air in the CLSM pour. To accomplish this, any plastic caps, wrappings, or other obstructions placed on pipes, valves, and other debris objects shall be cut or removed prior to pouring CLSM. The uncontainerized debris shall be spread horizontally across the lift. Any compressible debris in the lift shall be secured to ensure proper disposal and cover with CLSM. Any wood materials shall be spread throughout the lift to prevent localized stacking or concentration of wood materials.</p>	<p>Visually inspect the debris pour to ensure that the CLSM can flow throughout all uncontainerized debris in the waste matrix. Inspect pipes, valves, and other debris objects and ensure that sufficient access exists for CLSM to enter the debris interior and fill voids. Verify that all compressible debris is properly secured. Ensure that wood materials are spread throughout the lift and not stacked or nested together.</p>	<p>Verify the large debris inspections have been performed and documented on the CLSM Inspection and Testing Form.</p>
<p>88) CLSM POURS WITH DEBRIS-FILLED CONTAINERS: In-filling of debris inside containers with CLSM shall be maximized. A minimum of two holes shall be punched into the bottom of one of the walls of each box container to allow for flow throughout the container. Containers filled with primarily wood materials shall not be disposed with CLSM, and must be emptied and spread out prior to placement.</p> <p>Lids shall be removed from all box containers prior to pouring CLSM (unless a specific waste stream or shipments are exempted by <u>UDRC DWMRC</u> for safety or ALARA considerations). Drum containers do not require</p>	<p>Visually inspect compressible debris inside containers to ensure the debris is secured. Ensure lids are removed from all box containers. If the lid shall remain on the drum container (or other waste container specifically exempted by <u>UDRC DWMRC</u>), ensure that the lid has</p>	<p>Review inspection results to ensure that compressible debris is being properly secured and that adequate holes exist for containers where lids remain on the container.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
removal of the lid. However, a drum container lid shall be pierced with a hole size of at least <u>eight square inches (i.e., 2-two inch" X-by 4-four inch")</u> to allow flow of CLSM into the container. If any container includes compressible debris, the material shall be secured to remain inside the container. Drum Containers that contain compressible debris shall have the lid removed or a six-inch CLSM cap shall be placed over the filled container.	been pierced with <u>at least one hole for drums and two holes for boxes. Holes shall be a minimum of 8eight square inches (i.e., two inch by four inch)-the proper size and number of holes.</u> Record results on the CLSM Inspection Form.	
Hot particles are very small, often microscopic discrete radioactive fragments with high specific activity. Their presence or potential presence in a waste stream is documented on the waste profile record. To protect worker health and safety, waste containers up to 115 215 cubic feet containing asbestos, beryllium, <u>DU metal</u> or hot particles do not require in-filling of debris inside the containers to be maximized. Box lids and at least one wall shall be punctured with a minimum of two holes at least <u>eight square inches (i.e., 2two inch" X-by 4four inch")</u> . Containers placed in this manner shall be marked as "asbestos", "beryllium", " <u>DU</u> " or "hot particle" waste and shall have a six inch CLSM cap placed over them.	If the lid remains on the drum container, ensure that the required number and size of holes exist in the lid. A flowability test is not required on containers filled with soil or fine grained materials. Ensure that containers with asbestos, beryllium, <u>DU metal</u> or hot particle waste are marked. Document the location of each such container within the pour <u>on a survey report or a map of the area.</u> Ensure that the lift is not approved without placement of a six-inch CLSM cap.	
<u>89) CLSM POURS WITH SOIL-FILLED CONTAINERS:</u> Containers that are filled with soil-like materials may be placed with CLSM. The lid may remain on the container. However, <u>a minimum of two holes of at least eight square inches (i.e., 2two inch" Xby 4four inch")</u> holes must be placed in the lid as required for compressible debris-filled containers <u>in Specification 878</u> above .		

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>90) CLSM POURS WITH RESIN-FILLED CONTAINERS: Containers that include or are filled with ion-exchange resin materials may be placed with CLSM. Cardboard, wood, and soft plastic “supersack” containers are expressly prohibited from use as the sole container for resin disposal in CLSM.</p> <p>At least ten percent (10%) of all resin-filled containers placed in each CLSM lift area shall be tested for free liquids, according to Procedure “CL-CW PR 200 Package Liquid Void Verification”.</p> <p><u>Resin filled containers shall be clearly marked on their lids designating resins are present in the container. HIC liners are assumed to contain resins and do not need a marking. Paint or mark the word “RESIN” on all four sides and the lid of each resin filled container when requiring void filling and sealing operations are complete.</u></p> <p>Headspace voids of resin filled containers may only be filled with Portland cement CLSM either prior to final placement or as part of a CLSM pour.</p> <p>Prior to pouring CLSM, caps (internal access point for HICS and other liners) may be removed from liners, with steel caps exceeding 0.5 inches thickness, to fill headspace voids. For all other containers, lids may not be removed. If not removed, lids of cylindrical containers of diameter less than three feet shall be pierced with one hole of size of at least <u>eight square inches (i.e., 2-two inch” X-by 4-four inch)”</u> to allow flow of CLSM into the container headspace void. If not removed, lids or the highest flat surface of all containers, other than cylindrical of diameter less than three feet, shall be pierced with a minimum of <u>two</u> holes</p>	<p>Verify that ion-exchange resin containers are constructed of steel or poly. Document this inspection on the CLSM Inspection Form.</p> <p><u>Assure operations documents</u> the results of the free liquid inspection and container numbers. on the ES-1902, Daily Construction Report.</p> <p>Document that the container has been painted or marked as required.</p> <p>Document that the material used to fill any headspace voids is Portland cement CLSM</p> <p>Document that lids have been <u>removed or</u> punched with the correct number and size of holes.</p> <p>Verify <u>and document</u> that CLSM drop height does not exceed limitation <u>and CLSM overflow is minimized.</u></p>	<p><u>Review documentation to ensure CLSM pours have been documented according to this specification.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>of size of at least <u>eight square inches (i.e., 2-two inch" X-by 4, four inch)</u>" to allow flow of CLSM into the container void space. All containers for headspace void remediation shall be placed vertically prior to filling in a CLSM pour.</p> <p>When filling a container, CLSM shall not be dropped from a height exceeding 10 feet, as measured from the point of discharge to the highest surface of the resin-filled container, and the pouring methods shall minimize CLSM overflow from within the containers into the surrounding pour areas.</p> <p>shall be focused on void headspace filling prior to backfilling the remainder of the larger pour area.</p> <p><u>CLSM poured across the top of the resin-filled containers shall not intermix with the CLSM used for filling headspace voids (i.e.g., CLSM used for filling headspace voids shall be allowed to harden prior to pouring across the top of the container).</u></p> <p>All resin-filled containers shall have a six inch CLSM cap placed over the filled container.</p> <p>The total waste resin volume shall be limited to no more than 25 percent of the total volume of the CLSM pour. Other wastes meeting the criteria for CLSM disposal, as outlined in this CQA/QC Manual, may be used to make up the remainder of the volume of the pour.</p> <p>Except for the placement of boxes, containing drums, and other smaller resin-filled packages, prior to void headspace filling, containers of ion-exchange resins shall not be placed directly adjacent to each other within the CLSM pour. Containers of ion-exchange resins shall not be</p>	<p><u>Verify and document that CLSM pouring methods prevent intermixing of CLSM used for filling headspace voids with CLSM used to cover the remainder of the container.</u></p> <p>Prior to the CLSM pour, calculate the ratio of resins to other material in the pour as follows:</p> <p>a. (1) Document the container type and volume for each container of resins in the pour;</p> <p>b. (2) Document the total pour volume based on the formed area x height;</p> <p>c. (3) Resin volume divided by total volume x 100 = resin percentage. Container volume may be calculated from the nominal capacity or from manifested volume of resins in the container.</p> <p>Survey and document the location of each resin-filled container on the CLSM Inspection Form and include with the Lift Approval Form. Verify that each resin-filled containers is are not placed directly above resin-filled containers in previous lifts within the CLSM pyramid.</p>	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
	<p>another proof-roll test of the area to evaluate if the repair was adequate. Repeat this process until satisfactory results are achieved; or</p> <p>c. Place a six-inch CLSM cap over the pour lift area after the area in question has been compacted. <u>With the exception of edges at the perimeter of a lift, The the</u> six-inch cap shall extend a minimum of three feet(3') past the damaged areas created during proof-rolling in each direction. Following a minimum of three calendar days, perform a proof-roll test of the six-inch cap area to evaluate if the cap was adequate. This process may also be repeated (i.e., placement of additional cap to a 12-inch cap) until satisfactory results are achieved.</p>	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>93) SIX-INCH CAP: All containers filled with compressible debris that do not have the lids removed shall have a six inch CLSM cap poured over the top of the containers prior to proof rolling. In addition, any CLSM pours that have areas which did not pass the proof rolling test may have a CLSM cap placed over those areas. A six-inch cap is required as described in Specification 88 and 90. Additionally, a six inch cap may be utilized for repairs to CLSM pours that do not pass the proof-rolling test of Specification 92. Areas poured with a CLSM cap shall still require a proof-rolling test (as described in Specification 94²above) to verify performance adequacy of the cap. With the exception of edges at the perimeter of a lift, the The six inch cap shall extend a minimum of three feet in each direction past the edge of the container area that requires a cap.</p> <p>The minimum compressive strength of the CLSM cap shall be 500 psi. The six inch cap shall have minimum 28-day strength of 500 psi as determined by ASTM D4832. Table 2 and Table 3 specifications do not apply to the CLSM cap.</p>	<p>Visually inspect the CLSM pour area and identify the highest elevations of debris that requires a six-inch cap. Survey and document these designated elevations on the CLSM Inspection Form. Following completion of the six-inch cap, perform a final survey of the entire lift as required for determining lift thicknesses above. <u>Document the survey on a survey report.</u> Ensure that the thickness of the cap is six inches above all debris requiring a CLSM cap. and that the cap extends three feet in each direction past the edge of the area that requires the cap. Document the inspection and completion of the CLSM cap on the Lift Approval Form.</p> <p>Perform compressive strength testing of the CLSM used for caps at the rate of one+ test per <u>1,000 cubic yards of CLSM placed, with at least one test per lift.</u> Test specimens/samples shall be collected in accordance with ASTM D5971 (Sampling Freshly Mixed CLSM). The samples shall then be tested in accordance with ASTM D4832 (Preparation and Testing of CLSM Test Cylinders). <u>The test results are documented in the contractor's compressive strength report which is referenced on the Lift Approval Form.</u> If the CLSM cap does not meet specification, evaluate why it failed and implement corrective actions to prevent recurrence. <u>Document corrective actions on the Daily Construction Report.</u></p>	<p>Review the documentation associated with the CLSM cap.</p> <p>Verify that compressive strength testing is performed at a rate of one+ per CLSM lift. Ensure that the compressive strength of the cap is greater than or equal to 500 psi.</p>
<p>94) IN-CELL BULK DISPOSAL/LLRW STORED WASTE: For both LLRW and 11e.(2) waste: Any waste material taken to the disposal cell but not spread out (for lifts placed with compactable soil) or set into a CLSM lift area for forming (for debris to be placed using CLSM) shall be considered in-cell bulk disposal/storage/stored waste. In-cell bulk</p>	<p>On a monthly basis, calculate and document the volume of in-cell bulk disposal/<u>stored waste</u> and waste stored on the LLRW storage pads. Stop waste unloading before the volume of waste stored exceeds the volume specified in the <u>current LLRW Surety trust agreement.</u></p>	<p>Review documentation of in-cell bulk disposal and ensure that volumes do not exceed the <u>current LLRW trust agreement</u> <u>Surety.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>disposal/storage/stored waste may be temporarily managed in piles up to twenty-five feet high on the embankment. <u>The total volume of waste in storage shall not exceed the volume reported in the current LLRW Surety.</u>For 11e.(2) waste: In-cell bulk disposal/storage cannot be placed on slopes steeper than approximately 5H:1V. The volume of in-cell bulk disposal/storage shall not exceed the limits found in RML #UT-2300478, condition 10.8.e. In order to prevent excess stockpiling, aAll 11e.(2) in-cell bulk storage placement wastematerial shall be placed to final specificationsdisposed by August 1 of each year.</p> <p>Open-air storage of PCB/Radioactive waste and Dry Active Waste (DAW) is prohibited. DAW is defined in condition 1.E.10.(d) of the Ground Water Quality Discharge Permit <u>UGW450005</u>. In-cell bulk disposal of PCB and DAW shall be managed to prevent open-air storage as follows:</p> <p>A. Maintained in a water-tight container; or</p> <p>B. Covered within 24 hours of the end of the shift that the waste was unloaded with a nominal <u>six inches</u>6" of soil or soil-like waste material that is free of PCB and DAW; or</p> <p>C. Covered within 24 hours of the end of the shift that the waste was unloaded with a commercial fixative to prevent wind dispersal and leachate generation, applied in accordance with the manufacturer's instructions; or</p> <p>D. The following PCB wastes do not require cover to prevent wind dispersal:</p> <ol style="list-style-type: none"> 1. Drained equipment; 	<p>Obtain reports from waste disposal personnel as to the location and status of PCB and DAW in-cell bulk disposal/<u>stored waste</u> at the beginning of each shift. When material requiring cover has been placed into in-cell bulk disposal during the preceding shift, track placement of the specified cover material. Document completion of cover within the required timeframe on the Daily Construction Report.</p>	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>2. Large objects with inaccessible PCB contamination; or</p> <p>3. PCB bulk product waste (as defined in 40 CFR 761.62(b)(1)(i)) with a bulk density greater than 70 pounds per cubic foot.</p> <p>When cover is required, maintain documentation <u>document</u> of the date and shift that PCB and DAW were placed in in-cell bulk disposal/<u>storage</u> and of the date and shift that cover was applied.</p> <p>The volume of in-cell bulk disposal plus the volume of waste stored at the LLRW container storage pads (e.g. LLRW bulk storage pad, LLRW container storage pad, etc.) shall not exceed the volume allowed in the trust agreement.</p> <p><u>95) 11e.(2) STORED WASTE: Any waste material taken to the disposal cell but not spread out (for lifts placed with compactable soil) or set into a CLSM lift area for forming (for debris to be placed using CLSM) shall be considered in-cell bulk storage. In-cell bulk storage may be temporarily managed in piles up to twenty-five feet high on the embankment. In-cell bulk storage cannot be placed on slopes steeper than approximately 5H:1V. The volume of in-cell bulk storage shall not exceed the limit found in RML #UT 2300478, condition 10.8.e. In order to prevent excess stockpiling, all bulk storage waste shall be disposed by August 1 of each year.</u></p>	<p><u>On a monthly basis, calculate and document the volume of in-cell bulk storage. Stop waste unloading before the volume of waste stored exceeds the volume specified in Condition 10.8.e. of RML #UT 2300478.</u></p>	<p><u>Review documentation of in-cell bulk disposal and ensure that volumes do not exceed the License limit.</u></p>
<p>COLD WEATHER PLACEMENT <u>(956 thru 978)</u></p> <p>96) FROZEN MATERIAL: No frozen material shall be disposed directly on or within 24 inches of the clay liner. Frozen material is defined as material which cannot meet the compaction requirements</p>	<p>During cold weather, inspect material to be disposed directly on the clay liner. Do not allow frozen material to be disposed on the clay liner. Record corrections on the "Daily Construction Report"<u>Daily Construction</u></p>	<p>Verify that inspections for frozen material are being conducted during cold weather and that any corrective actions (if required) are properly documented.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
because of frozen water mixed within the material.	<u>Report.</u>	
97) PLACEMENT OF WASTE DURING COLD WEATHER: Waste material shall only be placed when the required moisture and compaction can be met.	1. For soil lifts:	1. For soil lifts:
<u>For soil lifts:</u>	<p>a.) On November 1, decrease density and moisture lot size to 750 cubic yards (compacted).</p> <p>b.) On December 1, and continuing to March 1, decrease density and moisture lot size to 500 cubic yards (compacted).</p> <p>c.) Stop placement of waste on a lift. When two consecutive tests fail compaction requirements due to frozen material <u>the lift.</u> The first "unapproved" lift is classified as in-cell bulk disposal/storage and managed in accordance with Specification 94. This action will be noted in the Daily Construction Report.</p> <p>d.) When temperatures are high enough to place the in-cell bulk disposal/storage material, place the material in accordance with (Specifications 74 and 75), and in accordance with the following criteria: lift thickness and compaction requirements specified for waste lifts above.</p> <p>1) If more than two2 feet of waste was stored as in-cell bulk disposal/storage, excavate to a maximum of 12 inches above the last approved waste lift. Test and approve this in accordance with lift thickness and compaction requirements given aboveSpecifications 74 and 75.</p>	<p>Verify that the testing frequency is increased at the beginning of November, and December. Verify that <u>waste failing two consecutive compaction tests are classified as in-cell bulk disposal/storage and noted in the Daily Construction Report.</u>work stops on a lift after the failure of two consecutive compaction test and that the lift is surveyed before the placement of in-cell bulk disposal.</p> <p>2. For CLSM pours:</p> <p>a)</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
For CLSM pours:		
<u>A.a)</u> Do not pour CLSM on a frozen <u>soil</u> -base.	2) If less than two 2 feet of <u>waste was stored as in-cell bulk disposal/storage waste—was disposed over the last approved lift</u> , excavate to the top of the last approved lift and re-test this lift in accordance with <u>lift thickness and compaction requirements specified above (Specifications 74 and 75).</u> <u>2. For CLSM pours:</u>	<u>When required, review</u> Review documentation of tenting, heating, and temperature measurements. <u>soil base testing to verify that CLSM is not to be poured on a frozen soil base.</u>
<u>B.b)</u> If the ambient air temperature is forecast to drop below 5°F anytime during the CLSM pour, CLSM shall not be poured. When the ambient or expected air temperature will fall below 35°F anytime during the CLSM pour, the CLSM shall be sampled and an initial screening test performed as outlined <u>under the CLSM Design Specifications specification above (Specification 856).</u> This initial sample may be used to prompt an adjustment of the load water content or temperature, modify the pour techniques, motivate rescheduling of the pour event, etc., but should not be considered acceptance sampling and testing. Acceptance sampling and testing should be obtained in accordance with ASTM D5971 (Sampling Freshly Mixed CLSM).	<u>a)</u> <u>If ambient temperatures are less than 35°F for three successive days, the pour area shall be tented and heated for 24 hours prior to pouring. The temperature inside the tented area shall be continuously monitored on the opposite end of the tent from where heat is being applied. The ambient temperature within the tented area shall be greater than 50°F for a minimum of 12 hours prior to pouring. If the CLSM is to be poured on a soil base, perform a soil density test on adjacent material prior to the pour to determine if the underlying soil is frozen. Document on a Density Test form. If the soil is found to be frozen do not allow placement of material.</u> <u>b)</u> When the ambient or expected air temperature will fall below 35°F anytime during the CLSM pour, perform an initial screening test of the CLSM immediately before pouring to ensure that it meets the flowability criteria. This screening test includes either a Flow Consistency Test (ASTM D6103) or Efflux test (procedure given in Appendix A), <u>as well as a unit weight test (ASTM D6023).</u> The result from this initial screening test shall indicate whether or not any adjustments need to be made at the batch plant to ensure loads meet design specifications.	During freezing conditions, verify that QC personnel have performed initial sampling and testing of the CLSM to ensure flowability. <u>Verify</u> ensured that the CLSM has been covered with concrete blankets or tented and heated, where required. Verify that QC personnel have periodically checked the temperature of the CLSM and recorded the results on the "CLSM Inspection and Testing Form". <u>b)</u> <u>Review documentation of screening tests to ensure that CLSM met flowability specifications during cold weather.</u> <u>e)</u>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>e-</p> <p>C Unless the ambient air temperature is at least 35°F and rising, measures must be taken to ensure the CLSM temperature does not fall below 40°F. To ensure this occurs and therefore the CLSM can adequately cure prior to exposure to freezing temperatures, the following should occur: Limit the pour to a surface area of no more than 4,800 #²<u>square feet</u>. Heat the CLSM prior to pouring (as possible). Cover, or tent and heat, the CLSM directly following pouring (i.e., pour one truck load, cover or tent the in-place material, then pour the next truck load). Following completion of the pour, cover the CLSM with concrete blankets, or tent and heat the CLSM. Likewise, if following placement, the ambient air temperature decreases below 35°F, or is anticipated to decrease below 35°F anytime in the 24 hours following placement, the CLSM must be covered with concrete blankets, or tented and heated.</p>	<p>a.4) If adjustments are made to the load to produce a product that passes the testing requirements, perform initial screening testing on the subsequent two loads to verify that batch plant adjustments are sufficient.</p> <p>b.2) CLSM pouring shall only be authorized to proceed upon verification that the initial load (and subsequent two loads if the initial load failed) meets mix specifications.</p> <p>Perform acceptance sampling and testing from near the center of the load.</p> <p>a. Accept loads which meet specification.</p> <p>b. For loads with unsatisfactory results, accept the first part of the load and reject the remainder, or modify the load and/or pour techniques and retest. Record the results on the "CLSM Inspection and Testing" forms.</p> <p>e)</p> <p>When the ambient air temperature decreases to below 35°F, ensure the CLSM temperature does not fall below 40°F. Measure and record the temperature of each CLSM load prior to introduction to the cell. Ensure the freshly poured CLSM is covered or tented and heated in a timely manner. Measure and record the temperature of the in-place CLSM every two hours during pouring, at the end of the work shift and at the beginning of the next work shift. Temperature results of pour temperatures shall be recorded on the "CLSM Inspection and Testing" forms. If, following placement, the ambient air temperature decreases below 35°F, or is anticipated to decrease below 35°F anytime in the 24 hours following placement of the CLSM, verify that concrete blankets or tenting and heating has been employed to ensure the CLSM is maintained greater than 40°F. Record the results of the inspection on the "CLSM Inspection and Testing" forms.</p>	<p>Review documentation of CLSM temperature measurements and actions taken for cold weather pouring to verify that CLSM temperatures meet specifications.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>98) SNOW REMOVAL: When waste material is to be placed and the work area is covered with snow and/or ice, the snow and/or ice must be removed so that no more than <u>1/4 one quarter</u> inch remains on the surface. Isolated individual clumps of snow and/or ice may be present, but shall be no larger than <u>two2</u> inches in diameter.</p>	<p>Observe that snow is removed. <u>Inspect the waste lift for damage. Advise-Notify</u> the Project Manager of deficiencies/<u>damage</u>. Construction may not continue without corrective action <u>and re-inspection of deficiencies/damage</u>. Record corrective action (where required) in the <u>"Daily-Construction-Report"</u><u>Daily Construction Report</u>.</p>	<p>Verify that snow removal is being performed and documented <u>and the waste lift has been inspected</u>.</p>
<p>99) FINAL GRADING BEFORE TEMPORARY COVER PLACEMENT: Top of waste elevations shall be at <u>grade</u> or below <u>design elevations</u><u>grade</u>. Also, special attention shall be taken to emphasize complete and thorough void filling around and within any debris in the final waste lift.</p> <p>If the last lift of waste was built to work element—Waste Placement (as opposed to work element—Waste Placement with Compactor), then a proof roll of the top of waste surface shall be performed.</p> <p>A visual inspection shall beis performed atof the top of waste surface. Any incompressible debris protruding greater than 0.1 1/2 one-half<u>0.5</u> foot above the <u>design top of waste</u> surface shall be compacted into the lift or removed.</p>	<p>Survey the top lift of waste on a 50 <u>foot</u> grid and at key points (<u>i.e., embankment break lines</u>). Final survey measurements will be documented <u>on a survey report</u> and provided to the QC <u>Supervisor</u> and <u>Construction QA Officers</u><u>Quality Assurance</u>.</p> <p>a. Indicate where the waste meets design line and grade.</p> <p>b. Rework and resurvey areas not meeting the specified grade.</p> <p>Observe the proof roll and document on the "Daily Construction Report". Advise the project manager of any "soft spots" or other areas of concern. Perform the visual inspection. <u>Advise-Notify</u> the Project Manager of any deficiencies. Document inspection results on the <u>"Daily-Construction-Report"</u><u>Daily Construction Report</u> <u>and re-inspect deficiencies</u>. <u>If satisfactory, notify QA that the surface is ready for QA inspection.</u></p>	<p>Review the final survey data. Verify the frequency of the survey points.</p> <p><u>Perform a visual inspection of the final elevation surface and provide written approval.</u> <u>Provide written approval of the final elevation surface</u></p>
<p>100) DRCREGULATORY APPROVAL: The DRC<u>DRC</u><u>DWMRC</u> or DSHW (for the LLRW/11e.(2) or Mixed Waste embankments, as applicable) shall approve the final <u>surface</u><u>grade</u> before temporary cover placement. 48 hour notification shall be provided to the DRC<u>DRC</u><u>DWMRC</u> or DSHW prior to placement of temporary cover material over the finished final <u>waste</u> <u>grade</u> surface. Energy <u>Solutions</u> may proceed with temporary cover placement 48</p>	<p>Notify the Construction QA Officer <u>Quality Assurance</u> that the final grade surface is ready for DRC or DSHW inspection. Obtain written authorization from the Construction QA Officer <u>Quality Assurance</u> that the final <u>grade</u> surface has been inspected. Obtain documentation (<u>e.g., notice of inspection, email, letter</u>) confirming the DRC<u>DRC</u><u>DWMRC</u> or DSHW inspection and approval.</p>	<p>Provide written approval of the final grade surface. Notify DRC<u>DRC</u><u>DWMRC</u> or DSHW (by email) that the final <u>grade</u> surface is ready for inspection. <u>Provide QC with documentation of</u> DRC<u>DRC</u><u>DWMRC</u> or DSHW inspection and approval.</p>

LLRW and 11e.(2) CQA/QC MANUAL
 TABLE 1 - QA/QC ACTIVITIES
 WORK ELEMENT – WASTE PLACEMENT WITHOUT COMPACTOR

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
hours after DRC notification if the DRC <u>DWMRC</u> or DSHW has not inspected and has not notified the Director of Engineering <u>Manager, Engineering</u> and Maintenance <u>Quality Assurance</u> of its intent to inspect the final grade surface.		

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT TEST PAD

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>101) SCOPE: This work element applies to the Class A West embankment.</p>		
<p>102) NOTICE OF TEST PAD CONSTRUCTION: The <u>Containerized Waste Facility Waste Placement Test Pad (CWF Test Pad)</u> test pad plan shall be provided to approved by approved by the DRCDWMRC. The CWF Test Pad plan shall be provided to the DWMRC <u>at least 14 calendar days</u> prior to the test pad construction. If DWMRC has not provided approval or deficiency notification prior to the end of 14 calendar days, construction may proceed as proposed in the CWF Test Pad plan. The DRC/DWMRC shall be notified 2448 hours in advance of the start-up of test pad construction.</p> <p><u>The DWMRC shall be notified 48 hours in advance of the start-up of test pad construction.</u></p>	<p>Obtain documentation confirming that the test padCWF Test Pad plan has been provided to approved by approved by the DRCDWMRC or the 14 calendar day period has ended. Notify the DRC 48 hours in advance of test pad construction. Obtain documentation confirming that the DWMRC has been notified, as required, notification.</p> <p><u>Obtain documentation confirming that the DWMRC has been notified, as required.</u></p>	<p>Verify that the test padCWF Test Pad plan has been provided to approved by the DRCDWMRC at least 14 calendar days prior to construction of the test pad. Verify that the DRC has been notified as required. Notify the DRC/DWMRC 2448 hours in advance of test pad construction. Provide QC with documentation of DRC/DWMRC notification. Provide QC with documentation of DWMRC approval or documentation that the 14 calendar day period has expired.</p> <p><u>Notify the DWMRC 48 hours in advance of test pad construction. Provide QC with documentation of DWMRC notification.</u></p>
<p>103) CONTAINERIZED WASTE PLACEMENT TEST PAD: A test pad with a minimum area of 400 ft²<u>-square feet</u> will be constructed using this procedure (container or large component type, container configuration, backfill material properties, placement and compaction methods) proposed for construction of the waste lifts. The test pad shall be representative of anticipated field placement conditions and of dimensions suitable to the equipment to be used for production. The minimum area of the test pad may be reduced with DRCDWMRC concurrence with the test pad plan.</p>	<p>Observe the construction of test pads. Measure test pads to ensure that they are constructed to the size indicated. Record the test pad size on the "Daily Construction Report"<u>"Daily Construction Report"</u>.</p>	<p>Daily, observe the construction of the test pads. The qQuality aAssurance review for test pad specifications shall cover each specification in this work element. Review 100 percent% of the QC documentation to verify that the tests were performed and documented correctly. Note QA observations on the Daily QA Report.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT TEST PAD

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>Prior to implementation, within the Containerized Waste Facility, of a containerized waste configuration that has not been previously approved; a waste placement test pad shall be constructed utilizing the proposed containerized waste configuration.</p> <p>Test pads are to be constructed and tested in accordance with the following specifications:</p> <p>A1 Construct the proposed configuration of containerized waste in the test pad area.</p> <p>B2 At least one Proctor (or relative density) and classification test shall be conducted on the backfill material for each test pad.</p> <p>C3 Backfill shall be placed over and between the waste packages in a manner that encourages flow into void spaces. The backfill is to be placed and compacted by equipment and methods proposed for use during construction of the waste lifts. Other equivalent equipment may be used for placement or compaction of backfill with approval from the Manager, Engineering and Maintenance<u>Engineering Manager</u>Director of Engineering and DRCDWMRC.</p> <p>D4 The backfill surrounding the containers shall achieve an average density of at least 85 percent %standard proctor or 55 percent relative density for drum configurations, or an average density of at least 80-percent standard proctor or 50 percent relative density around B-12 or B-25 boxes, HICs, cask liners, large components, or container overpack</p>	<p>Document the constructed configuration of containers in the test pad on the "Daily Construction Report."</p> <p>Conduct the required proctor (or relative density) and classification (PL, LL, and gradation) tests.</p> <p>Record type of equipment used, and number of passes on the "Daily Construction Report"<u>Daily Construction Report</u>. Verify DRCDWMRC approval has been received for equivalent equipment when used.</p> <p>Conductdirect or indirect in-place moisture-density tests at a rate of at least four tests per test pad. Each<u>The</u> test location shall be chosen to verify backfill compaction throughout the test pad. Record the test result on the "Field Density Test" form. Inspect the constructed test pad for void spaces surrounding the containers. Observe destructive testing of the test pad and measure external void spaces found in the backfill in accordance with the "Containerized Waste Facility Waste Placement Test Pad Destructive Testing" method in Appendix B.</p>	<p>Perform a minimum of one (1) QA-visual inspection of the resulting waste form constructed configuration per test pad. <u>Record on the Daily QA Report.</u></p> <p><u>Review 100 percent% of the QC documentation for the test pad.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT TEST PAD

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
configurations. The completed test pad shall have no greater than one % <u>percent</u> external void space by volume of the entire test pad.	<p>a. Approve test pads which meet the specified compaction, and minimize void space conditions.</p> <p>b. Rework and retest test pads not meeting the specified moisture or compaction or minimize void space conditions. Document all rework that was performed.</p> <p>c. Where rework and retesting is impractical, reject the test pad procedure.</p>	
<p><u>E5.</u> The procedures used to construct the test pad (container type, container configuration/orientation, backfill material properties, placement and compaction methods) shall be reviewed and approved by the Director of Engineering <u>Manager, Engineering and Maintenance</u> Director of Engineering <u>Manager</u>. The test must be approved by a Professional Engineer.</p>	<p>Provide the Manager, Engineering and Maintenance <u>Engineering Manager</u> Director of Engineering with copies of the documentation for the test pad (<u>all documentation associated with this work element</u>) for review and approval.</p>	
<p><u>F6.</u> The procedures used to construct the test pad shall be reviewed and approved by <u>test pad certification report shall be provided</u> approved by the DRC <u>DWMRC</u> prior to using the new test pad construction method. <u>However, if the DWMRC has not provided approval or deficiency notification prior to the end of 14 calendar days from the time the certification report was submitted, construction may proceed using the new construction method.</u></p>	<p>Obtain documentation confirming DRC approval of the test pad. <u>Obtain documentation confirming that the test pad certification report has been approved by the DWMRC or the 14 calendar day period has ended.</u></p>	<p><u>Verify that the test pad certification report has been provided to the DWMRC. Provide QC with documentation of DWMRC approval or documentation that the 14 calendar day period has expired.</u></p> <p>Verify that proper approval has been obtained for the test pad and that the necessary construction procedure documents are in place for use during backfill construction.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
104) SCOPE: This work element applies to the Class A West embankment.		
105) LIFT IDENTIFICATION: Each lift shall be given a <u>unique lift identification number</u> discrete designation for testing and surveying purposes.	Assign a lift identification number to each lift. Use the lift identification number to identify all paperwork for that lift. Summarize all lifts on the lift summary form.	The g Quality a Assurance review for waste placement specifications shall cover each specification in this work element. Review a minimum of 50- 0 <u>percent</u> % of the QC documentation to verify that the tests were performed and documented correctly.
106) LIFT ACCEPTANCE: At the time of acceptance, the date and time of lift approval shall be recorded.	The QC technician shall record the date and time of lift approval on the CWF Lift Approval Form.	
DEFINITIONS: <u>The following terms are defined for the Containerized Waste Facility:</u> For the purpose of this CQA/QC project plan, the following terms are defined:	No action required.	No action required.
107) Backfill is defined as poorly graded type SP or well graded type SW sand with a minimum of 95 <u>percent</u> % passing the #4 sieve, a minimum of 35 <u>percent</u> % passing the #30 sieve, and less than 5-10 <u>percent</u> % passing the #200 sieve. The maximum moisture content for backfill shall be less than or equal to 4.1 <u>percent</u> % at the time of backfill placement. This specification may be modified following successful completion and DRC approval of a test pad. Backfill cover is defined as a minimum of one foot of soil placed over containerized waste packages after backfilling is complete. In the case of <u>caissons</u> , standard liners, and large liners, the <u>backfill cover is placed over the intermediate sand layer.</u> placement sequence is:		

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>A.(1) backfill between the waste forms;</p> <p>B.(2) intermediate sand;</p> <p>C.(3) backfill cover.</p> <p><u>Containerized waste</u> is defined as any containers of Certified Containerized Waste in accordance with applicable requirements of the Waste Characterization Plan. Certified Containerized Waste is defined as monolithic units in the form of the following filled containers.</p> <p>A. Any DOT “Strong, Tight” Containers up to five5 feet tall;</p> <p>B. <u>Standard Liners</u> are High Integrity Containers (HICs) or other cylindrical packages up to 6.65 feet tall (up to 215 cubic feet external volume);</p> <p>C. <u>Large Liners</u> are HICs or other <u>cylindrical</u> packages between 6.65 and up to nine9 feet tall (between 215 and up to 331 cubic feet external volume); or</p> <p>D. Other Large Components and oversized DOT containers (larger than 331 cubic feet)</p> <p><u>Containerized Waste Facility (CWF) pyramid</u> is limited to a maximum of two lifts of containerized waste. Containers up to five5 feet tall are limited to a single lift at the pyramid base. Containers greater than five5 feet tall are limited to two lifts. The volume of the embankment above and surrounding the pyramid shall be filled with bulk</p>		

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
waste lifts placed in accordance with the Bulk Waste Placement Work Element of this plan.		
<p><u>Intermediate sand</u> is defined as a minimum of two2 feet of sand meeting gradation specifications for backfill, placed above the top of caissons, standard liners, and large liners, used for placement of cylindrical containers greater than five5 feet tall. In the case of containers placed using removable steel forms, intermediate sand shall be placed to an elevation at least nine9 feet above the base of the container for standard liners and 11.5 feet above the base of the container for large liners.</p> <p><u>Lift</u> is defined as <u>the six inch sand layer</u>, containerized waste packages, backfill between packages, intermediate sand (when applicable), and the backfill cover layer. A containerized waste placement lift may contain one layer of containers or more than one stacked layer of containers, depending on the container type and height.</p> <p><u>Removable Steel Form</u> is a circular steel form used to ensure the spacing of standard or large liners. Removable steel forms are placed in an approved disposal configuration (hexagonal for example) prior to placement of liners. Removable steel forms can be used in either the first lift or second lift in place of caissons. All removable steel forms shall be pulled after liner placement and <u>before</u> backfill.</p>		
108) CONTAINERIZED WASTE PLACEMENT:	↪	↪
<u>A-1</u>) All containers shall be placed in	Verify through observation and document that the	Review the QC documentation to confirm that the

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>accordance with an approved container placement method. Containers shall be placed in a configuration that has been approved through the successful completion of a waste placement test padCWF Test Pad. Figures 7 and 8 illustrate approved waste placement configurations. A minimum six6-inch layer of loose sand shall be placed prior to placement of containers. Containers shall be worked into this loose sand to minimize any voids underneath the containers. Containers shall be placed with a minimum distance as specified by individual container type below. Backfill shall be placed over and between the containers in accordance with the approved container placement method for the type of container being placed. The containerized waste placement backfill soil properties shall be tested once per 2,500 square feet of placement area or once per lift.</p>	<p>appropriate container placement method and spacing is followed for the type of container stacking in each lift.</p> <p>Perform at least one moisture content and classification (PL, LL, and gradation) test per 2,500 square feet of placement area, or change in backfill material type, or change in borrow source.</p> <p>Conduct an inspection of the container placement configuration prior to commencement of backfill placement. This inspection shall document that an approved configuration has been utilized for the container types present.</p> <p><u>Perform moisture content testing on backfill material at least once each day backfill material is placed.</u> Observe placement and compaction of the backfill to ensure that type of equipment, equipment load (if applicable), and number of passes meet the specifications approved by the containerized waste placement test pad. Record type of equipment used, equipment load (if applicable), and number of passes on the CWF Lift Approval Form.</p>	<p>appropriate container placement and backfilling method has been used and properly documented.</p>
<p>B.2)Standard Liners shall be placed as follows. Spacing and backfill of standard liners may be facilitated by the use of concrete caissons or removable steel forms; use of caissons or removable steel forms is not required. Caissons or other forms shall not exceed seven7 feet tall. When used, removable steel forms shall be removed prior to backfill. Caissons shall not be removed without prior DRCDWMRC notification. Backfill shall be placed to a minimum height of seven7 feet above the container base elevation by dropping from the bucket of a front-end</p>	<p>2)Verify through observation and document on the CWF Lift Approval Form that standard liners are placed with the appropriate container placement method and spacing.</p> <p>Conduct in place density tests at the surface of the intermediate sand layer at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 10,000 square feet of a single lift. At least two tests will be performed per lift. The test location shall be chosen on the basis of random numbers (described in Specification 12). Approve lots when:</p>	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>loader or equivalent around and above the container (whether in a caisson or not). Backfill shall achieve a minimum density of at least 80 percent% of a standard Proctor, as demonstrated by the approved test pad(s). The backfill layer shall be covered by an intermediate sand layer to a minimum depth of two2 feet above the top of the caisson (9<u>nine</u> feet above the container base elevation). Intermediate sand shall achieve a minimum density of 85 percent% of a standard Proctor. The backfill cover layer is then placed above the intermediate sand layer. Caissons shall be placed in a hexagonal or other approved (through a test pad) configuration, such as rectangular, that meets the following criteria. Caissons with an outer diameter of 100 inches shall be placed a minimum of four4 inches apart. If no caisson is used, or if a caisson or other form of smaller outer diameter is used, the container shall be placed as if the 100-inch diameter caisson were there for spacing purposes; i.e., within a minimum area of 108-inch diameter centered around the container, no other caisson or container shall intrude.</p> <p><u>C.3</u>) Unusually shaped containers shall be placed and backfilled in a manner that allows void spaces to be filled. In no case shall unusually shaped containers be placed such that a significant amount of external void space cannot be filled. A significant amount of external void space for unusually shaped containers is five5 percent of the volume of the unusually shaped containers in the lift, unless otherwise approved by the</p>	<p>a. Material is observed to be properly compacted throughout the lot; b. Density tests performed meet compaction specifications.</p> <p>Verify the mean elevation of the top of each intermediate sand lift by installing grade poles, or other methods approved by the Site Engineering Manager. For each lift larger than 50' x 50', survey the corners and at least one spot in the middle. For lifts less than 50' x 50', a minimum of four grade poles, one in each direction, shall be used. Lifts larger than 50' x 50' may be segmented to areas 50' x 50' or less and elevation verified with the use of grade poles. The use of grade poles to verify the compacted thickness of the intermediate sand material shall be verified as part of the test pad for intermediate sand. Thickness measurements of the compacted intermediate sand will be documented and forwarded to the Construction QC Supervisor, QC Officer, Lead, QC Embankment Construction.</p> <p>a. Approve lifts with an average compacted intermediate sand thickness greater than or equal to the specified compacted intermediate sand thickness. b. Add intermediate sand and retest lots with an average compacted intermediate sand lift thickness less than the specified compacted intermediate sand lift thickness.</p> <p>3)</p>	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
Division <u>DWMRC</u> .		
D.4) Large components and oversized DOT containers shall be placed and backfilled such that void spaces are filled and the bearing capacity of the embankment is not exceeded.		
E.5) Large Liners shall be placed as follows. Spacing and backfill of large liners may be facilitated by the use of concrete caissons or removable steel forms; use of caissons or removable steel forms is not required. Caissons or other forms shall not exceed 9.5 feet tall. When used, removable steel forms shall be removed prior to backfill. Caissons shall not be removed without prior DRC <u>DWMRC</u> notification. Backfill shall be placed to a minimum height of 9.5 feet above the container base elevation by dropping from the bucket of a front-end loader or equivalent around and above the container (whether in a caisson or not). Backfill shall achieve a minimum density of at least 80 percent % of a standard Proctor, as demonstrated by the approved test pad(s). The backfill layer shall be covered by an intermediate sand layer to a minimum depth of two feet above the top of the caisson (11.5 feet above the container base elevation). Intermediate sand shall achieve a minimum density of at least 85 percent % of a standard Proctor. The backfill cover layer is then placed above the intermediate sand layer. Caissons shall be placed in a hexagonal or other approved (through a test pad) configuration, such as rectangular, that meets the following criteria.	Verify through observation and document that the unusual containers are placed such that all significant voids can be filled. 4)	
	Verify through observation and document that the large components and oversized DOT containers are	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>Caissons with an outer diameter of 114 inches shall be placed a minimum of five 5 inches apart and no more than 11 inches apart (at the nearest point between two adjacent caissons). If no caisson is used, or if a caisson or other form of smaller outer diameter is used, the container shall be placed as if the 114-inch diameter caisson were there for spacing purposes; i.e., within a minimum area of 124-inch diameter centered around the container, no other caisson or container shall intrude and adjacent caissons shall be within a maximum area of 136-inch diameter.</p> <p>E.6) Large Liners shall meet the following void space criteria: void spaces within the waste and between the waste and its packaging shall be reduced to the extent practicable, but in no case shall less than 90 percent of the capacity of the container be filled.</p> <p>G.7) Drums shall be placed horizontally at least 1-one inch apart in a single layer. There shall be no continuous contact between drums. Forklifts may be used for drum placement provided that protective measures are taken to prevent damage to the drums. The forklift tines shall not come into direct contact with the drums. Sand shall be compacted to an average standard proctor density of 85 percent% with a minimum of a single pass of a hoe mounted vibratory compactor or its equivalent, prior to placement of the next layer of drums. For purposes of this specification, the “Standard I-13 Liner” and “NUHIC-55 liners” may be placed as a drum.</p>	<p>placed in accordance with an approved large component placement method.</p> <p>5) Verify through observation and document that large liners are placed with an approved container placement method and spacing.</p> <p>Conduct in place density tests at the surface of the intermediate sand layer at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 10,000 square feet of a single lift. At least two tests will be performed per lift. The test location shall be chosen on the basis of random numbers (described in Specification 12). Approve lots when:</p> <p>a. Material is observed to be properly compacted throughout the lot;</p> <p>b. Density tests performed meet compaction specifications.</p> <p>Verify the mean elevation of the top of each intermediate sand lift by installing grade poles, or other methods approved by the Site Engineering Manager. For each lift larger than 50' x 50', survey the corners and at least one spot located near the center. For lifts less than 50' x 50', a minimum of four grade poles, one in each direction, shall be used. Lifts larger than 50' x 50' may be segmented to areas 50' x 50' or less and elevation verified with the use of grade poles. The use of grade poles to verify the compacted thickness of the intermediate sand material shall be verified as part of the test pad for intermediate sand. Thickness measurements of the compacted intermediate sand will be documented and forwarded to the Construction QC Supervisor, QC Officer, Lead, QC Embankment and Construction.</p> <p>a. Approve lifts with an average compacted</p>	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p><u>H.8)</u> When backfilling between standard or large caissons placed in a hexagonal pattern, the following controls apply as demonstrated in the “Test Pad Report for the Containerized Waste Facility Tri-Arc Test Pad Plan, Revised Plan” dated September 18, 2007. The loader or other equipment shall have a bucket of at least 25 cubic foot capacity and the bucket shall be totally filled. Dump the backfill sand from a height of approximately <u>two</u> feet above the top of the caisson (measured from the lower lip of the bucket to the top of the caisson).</p>	<p>intermediate sand thickness greater than or equal to the specified compacted intermediate sand thickness.</p> <p>b. Add intermediate sand and retest lots with an average compacted intermediate sand lift thickness less than the specified compacted intermediate sand lift thickness.</p> <p>6)</p>	
<p><u>I.9)</u> If placing ion-exchange resins in containers other than standard liners or large liners, ensure that each 50’ x 50’ lift area contains no more than 25 <u>percent</u> resins by volume. Increase spacing of resin containers as needed to maintain this criteria<u>criterion</u>.</p>		

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
	For large liners, document that the void space criteria is met. 7)	
	Document that drums have been placed as required. Document equipment used and number of passes <u>on a Daily Construction Report</u> . 8)	
	Document that the bucket used to place backfill sand meets or exceeds the minimum capacity. Observe sand dumping operations for compliance with the specification. Document on the Daily Construction Report. 9)	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>109) PYRAMID CONTROLS: Refer also to Figures 7 and 8. Containerized Waste Facility (CWF) Pyramid:</p> <p>A.1) Containerized waste lifts shall form a pyramid with a maximum 3H:1V outside edge slope. The slope shall be measured to the top of the backfill cover above containers in the lift.</p> <p>B.2) Drums and boxes less than five5 feet tall are limited to a single lift on the lower layer of the CWF pyramid. Standard and large liners are limited to two lifts.</p> <p>C.3) The pyramid base dimensions and maximum 3H:1V side slope requirements will control the location of the second lift of containers.</p> <p>D.4) Adjacent pyramids shall not be placed above a previous CWF pyramid.</p>	<p>Calculate the ratio of resins to other material (soil, non-resin wastes) in the lift based on manifested resin volume and actual lift dimensions. Nominal container capacity may be used instead of manifested volume. Resin volume divided by total volume x 100 = resin percentage. Document on the CWF Lift Approval Form.</p> <p>Determine the location of the northwest corner and the dimensions of each lift and document on the CWF Lift Approval Form. Use the lift location and dimensions to ensure compliance with thise containerized-waste facility-pyramid specification. As each lift of backfill cover is placed, survey and document that the corners of the lift meet the 3H:1V slope. If applicable, document the dimensions of the previous containerized waste facility lift on the CWF Lift Approval Form. In locating a new pyramid, document on the CWF Lift Approval Form:</p> <ol style="list-style-type: none"> The pyramid base is placed on the liner protective cover; or The pyramid base does not encroach the vertical limits of a previous pyramid. <p>Prior to positioning the first liner in a second lift, document the location of containers in the first lift. Ensure that the first liner placed in the second lift is offset so that it is not directly above any single liner in the lower lift. Document that large liners placed in the upper lift meet the setback criteria.</p>	<p>Verify compliance with thise containerized-waste facility-pyramid specification and proper documentation of the QC requirements <u>on the CWF Lift Approval Form</u>.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>E.5) CLSM pyramids for bulk waste shall not be placed above a previous CWF pyramid.</p> <p>E.6) CLSM may be used for fill within the initial lift of the container pyramid.</p> <p>G.7) The first liner placed in a second lift using this method shall be offset from liners in the lower lift.</p> <p>H.8) Large Liners placed in the upper lift of the Containerized Waste Facility shall be placed at least 75 feet from the outer perimeter of the lower lift.</p>		
<p>110) CLSM USE AS FILL: CLSM use as fill within the initial lift of the container pyramid shall comply with Specifications DRC Notification for CLSM Pours and “Portland Cement or Fly Ash CLSM Design Specifications” under Work Element Waste Placement above 84 and 85. However, CLSM used as fill at the Containerized Waste Facility is not required to meet the compressive strength requirement <u>of Specification 856</u> referenced above.</p> <p>CLSM may be used for fill with up to two, five5-drum pallets stacked inside a standard or large caisson. CLSM may also be used for fill with other waste containers that fit inside a standard or large caisson. The entire caisson height may be filled in a single CLSM pour.</p> <p>CLSM may also be used for fill around drums and boxes/containers less than five5 feet tall around the</p>	<p>Document Obtain documentation of DRCDWMRC notification and <u>Document</u> CLSM mix inspections and approval in accordance with the referenced specifications.<u>Specifications 84 and 85.</u></p>	<p><u>Notify DRC</u>DWMRC at least 48 hours in advance of CLSM use as fill. Provide QC with documentation of <u>DRC</u>DWMRC notification.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>perimeter of the CWF pyramid, so long as the 3H:1V pyramid slope is maintained. Drums placed in this manner may be oriented vertically.</p>		
<p><u>111) INTERMEDIATE SAND: Intermediate sand shall be placed above all caissons, standard liners, and large liners. Intermediate sand shall be placed a minimum of two feet above caissons. In the case of liners placed without caissons, intermediate sand shall be placed to an elevation of at least nine feet above the base of the container for standard liners and 11.5 feet above the base of the container for large liners.</u></p>	<p><u>Verify the mean elevation of the top of each intermediate sand lift by installing grade poles, or other methods approved by the Engineering Manager. For each lift larger than 50 feet x 50 feet, survey the corners and at least one spot in the middle. For lifts less than 50 feet x 50 feet, a minimum of four grade poles, one in each direction, shall be used. Lifts larger than 50 feet x 50 feet may be segmented to areas 50 feet x 50 feet or less and elevation verified with the use of grade poles. The use of grade poles to verify the compacted thickness of the intermediate sand material shall be verified as part of the test pad for intermediate sand. Thickness measurements of the compacted intermediate sand will be documented and forwarded to the Construction QC Supervisor.</u></p> <p><u>a. Approve lifts with an average compacted intermediate sand thickness greater than or equal to the specified compacted intermediate sand thickness.</u></p> <p><u>b. Add intermediate sand and retest lots with an average compacted intermediate sand lift thickness less than the specified compacted intermediate sand lift thickness.</u></p>	
<p><u>Intermediate sand shall achieve a density of at least 85 percent of a standard Proctor.</u></p>	<p><u>Perform at least one intermediate sand gradation and proctor test per 3,000 cubic yards (compacted) and anytime there is a change in material or borrow source. Conduct in-place density tests at the surface of the intermediate sand layer at a rate of one test per lot and record the results on the Field Density Test form. A lot is defined as 10,000 square feet of a single lift. The test location shall be chosen on the basis of random numbers (described in Specification 12). Approve lots</u></p>	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>5)112) BACKFILL COVER: After backfilling of voids between containers is complete and intermediate sand is placed (as needed), each lift of containerized waste shall be covered by at least one foot of compacted backfill cover material.</p> <p>Backfill cover for each lift shall achieve a density of at least 95 percent of a standard Proctor.</p>	<p><u>when:</u></p> <p><u>a. Material is observed to be properly compacted throughout the lot; and</u></p> <p><u>b. Density tests performed meet compaction specifications.</u></p> <p>1. For containerized waste lifts: Verify the mean elevation of the top of each backfill cover lift by installing grade poles, or other methods approved by the <u>Site Engineering Manager</u>. For each lift larger than 50 <u>’-feet</u> x 50 <u>’-feet</u>, survey the corners and at least one spot in the middle. For lifts less than 50 <u>’-feet</u> x 50 <u>’-feet</u>, a minimum of four grade poles, one in each direction, shall be used. Lifts larger than 50 <u>’-feet</u> x 50 <u>’-feet</u> may be segmented to areas 50 <u>’-feet</u> x 50 <u>’-feet</u> or less and elevation verified with the use of grade poles. The use of grade poles to verify the compacted thickness of the backfill cover material shall be verified as part of the test pad for backfill cover. Thickness measurements of the compacted backfill cover will be documented and forwarded to the Construction QC Officer/Lead, QC Embankment Construction <u>QC Supervisor</u>.</p> <p>a. Approve lifts with an average compacted backfill cover thickness greater than or equal to the specified compacted backfill cover thickness.</p> <p>b. Add backfill and retest lots with an average compacted backfill cover lift thickness less than the specified compacted backfill cover lift thickness.</p> <p><u>Perform at least one backfill cover proctor test per 3,000 cubic yards (compacted) and anytime there is a change in material or borrow source.</u> Conduct in-place density tests at the surface of the backfill cover at a rate of one test per lot and record the results on the Field Density Test form. A lot is defined as 10,000</p>	<p>Review the QC documentation.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
	<p>square feet of a single lift. At least two tests will be performed per lift. The test location shall be chosen on the basis of random numbers <u>(described in Specification 12)</u>. Approve lots when:</p> <ol style="list-style-type: none"> Material is observed to be properly compacted throughout the lot; <u>and</u> Density tests performed meet compaction specifications. <p>Perform a laboratory classification test on the backfill cover material at a rate of one test per 3,000 cubic yards (compacted), or change in backfill cover material type, or change in borrow source. The sample for this test will be taken from the backfill cover stockpile.</p>	
<p>113) SET BACK OF WASTE: Maintain a distance of at least 10 feet between the inside toe of the runoff berm and the outside toe of the waste containers.</p>	<p>Initial waste set back approval shall measure the setback distance around the edge of the runoff berm at 100 foot intervals <u>and place stakes for reference. The stakes may be removed after the first lift is completed.</u> Record the inspection of the setback on the "Daily Construction Report"<u>Daily Construction Report</u>.</p> <p>Inspect the waste setback on a monthly basis. Record findings on the "Daily Construction Report"<u>Daily Construction Report</u>.</p> <p>Require removal of any waste necessary to maintain the required set back.</p>	<p>Review the QC documentation to confirm that the monthly inspections have been performed and properly documented.</p>
<p>114) SNOW REMOVAL: When waste material is to be placed and the work area is covered with snow, the snow must be removed.</p>	<p>Observe that snow is removed. <u>Inspect the area for damage. Advise-Notify</u> the Project Manager of deficiencies/<u>damage and re-inspect after deficiencies/damage are corrected.</u> Construction may not continue without corrective action. Record corrective action (where required) in the "Daily Construction Report"<u>Daily Construction Report</u>.</p>	<p>Review the QC documentation to verify that snow removal is being performed and documented <u>and the area has been inspected.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – CONTAINERIZED WASTE FACILITY WASTE PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>115) Cold Weather Placement of Backfill COLD WEATHER PLACEMENT OF FLOWABLE SAND BACKFILL: The following requirements apply to placement of flowable sand backfill when the ambient air temperature is below 32 degrees Fahrenheit: A. Backfill with frozen clods shall not be accepted for placement. B. The backfill stockpile shall be worked using heavy equipment prior to use. C. The minimum average spread diameter for the flowability tests shall be 8.75 inches. D. If backfill is observed to have frozen clods or does not meet the flowability specification, the backfill stockpile may be re-worked. Each inspection and test shall be repeated for re-worked material.</p>	<p>When the ambient air temperature falls below 32 °F: a. Inspect the backfill stockpile to be used that day for any visible frozen clods. b. Observe working of the backfill stockpile. c. Perform a flowability test (ASTM D6103) on material from the backfill stockpile: 1) Collect a minimum of three representative samples from the backfill stockpile. 2) Test each sample using ASTM D6103. d. Record these actions and test results on the “Daily Construction Report.”</p>	<p>Review documentation and verify that the backfill stockpile is inspected, worked, and tested during cold weather conditions.</p>
<p>FINAL GRADING: Top of waste elevations shall be at grade or below grade.</p>	<p>Survey the top lift of waste on a 50 ft grid and at key points. Final survey measurements will be documented and provided to the Director of Engineering and Construction QA Officer. a. Indicate where the waste meets design line and grade. b. Rework and resurvey areas not meeting the specified grade.</p>	<p>Review the final survey data. Verify the frequency of the survey points.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – INTERIM RAD COVER PLACEMENT AND MONITORING

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>116) SCOPE: This work element applies to the Class A West embankment.</p> <p>117) DEFINITION: Interim rad cover is non-waste soil used to comply with the “uncovered radioactive waste” limit at Radioactive Material LicenseRML UT 2300249, Condition 11. This material was historicallyformerly referred to as “temporary cover” or “interim temporary cover”. Waste in closed containers may be stored on interim rad cover. If bulk waste is placed or stockpiled (temporarily placed) on interim rad cover, the affected area (the area occupied by the placed or stockpiled waste) shall no longer be considered to have interim rad cover on it.</p> <p>The following areas do not count against the “uncovered radioactive waste” limit at RML Condition 11 and do not require interim rad cover to be placed over them:</p> <p><u>A.</u> Containerized Waste Facility</p> <p><u>B.</u> Large Component disposal areas</p> <p>A-C. CLSM pour areas that have been poured and covered.</p> <p>Note: Areas where debris has been staged or formed for CLSM, but have not yet been poured and covered shall be counted against the “uncovered radioactive waste” limit.</p>		
<p>118) INTERIM RAD COVER MATERIAL: Interim rad cover shall be non-wastenative soil that is free of debris material.</p>	Visually inspect interim rad cover soil <u>for debris</u> and document on the Daily Construction Report.	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – INTERIM RAD COVER PLACEMENT AND MONITORING

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>119) INTERIM RAD COVER PLACEMENT: Interim rad cover shall be a minimum of six6 inches thick in order for an area to be removed from the “uncovered radioactive waste” inventory. Thickness shall be evaluated through use of grade poles or survey. Contaminated equipment may be used to place interim rad cover.</p> <p>A commercial fixative product (i.e., polymer), magnesium chloride, or non-contact water may be applied, in accordance with the manufacturer’s instructions, to the surface of the interim rad cover to aid in dust control and erosion prevention. Erosion control blankets, mats, or fiber mulch may also be used, in accordance with the manufacturer’s instructions, for erosion prevention. DRCDWMRC shall be notified at least 48 hours prior to deployment of erosion control blankets, mats, or fiber mulch.</p>	<p>Survey at least the perimeter of the area covered and document. Document the -thickness of the cover on the Daily Construction Report.</p>	<p>Periodically observe lift approval documentation.</p>
<p>120) OPERATIONAL CONTROLS: Interim rad cover shall be fenced, roped, or otherwise marked to identify as distinct from active waste placement areas. Traffic across interim rad cover shall be minimized. Haul roads are prohibited on interim rad cover.</p>		
<p>121) INSPECTIONS: Monthly, inspect interim rad cover for the presence of erosion gullies. If the inspection indicates that waste material is exposed due to erosion, the interim rad cover shall be repaired in that area within seven7 calendar days.</p>	<p>Perform monthly inspections and document on the Daily Construction Report.</p>	
<p>122) SURVEYS: Quarterly, perform an elevation survey on interim rad cover that is within two2 feet of the design top of debris waste elevation. Surveys shall be performed at the temporary and</p>	<p>Perform quarterly surveys and document.</p>	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – INTERIM RAD COVER PLACEMENT AND MONITORING

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>final settlement monument locations provided in Figure 2, within an 18 inch radius of the design monument location.</p> <p> 123) REMOVAL: Interim rad cover may be removed. Soils used as interim rad cover may be used as fill for debris wastes. If used, erosion control blankets, mats, or fiber mulch may be left in place or removed, but either way must be placed and compacted as waste.</p>		

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – TEMPORARY COVER PLACEMENT AND MONITORING

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>124) SCOPE: This work element applies to the Class A West and 11e.(2) embankments. Because there is no open cell time limit for the 11e.(2) embankment, time limits within this specification do not apply there.</p>		
<p>125) TEMPORARY COVER MATERIAL: Temporary cover shall be native CL_s or ML_s or CL-ML soils that are free of debris material that could penetrate the radon barrier. This material provides an adequate thickness of material free of debris to protect the overlying radon barrier.</p>	<p>Perform laboratory classification tests at a rate of <u>one+</u> test per lot prior to use of material. A lot is defined as a maximum of <u>6000-5,000</u> cubic yards (compacted) of specified material type. Record the location of the classification sample on the "Sampling Log". a. Approve lots which meet the specified classification for use. b. Lots not meeting the specified classification can not be used. Visually inspect temporary cover soil and verify that it is free of debris. Record results on the Lift Approval Form.</p>	
<p>126) TEMPORARY COVER PLACEMENT: Temporary cover shall be placed within 15 years of the date of initial waste placement on each lift area; and within 90 days of any survey that determines top of waste elevations and grades for each lot. Top of waste elevations and grades are defined as those found on the approved engineering design drawings <u>listed in Groundwater Quality Discharge Permit UGW450005</u> authorized under the license. <u>DRCDWMRC</u> shall be notified in writing <u>(including email)</u> at least 48 hours in advance of the start-up of temporary cover placement.</p> <p>A side slope exemption is limited to the 90 calendar day requirement for temporary cover placement, which does not apply to side slope areas immediately adjacent to top slope lifts that have not reached the top of waste elevations. Once the</p>	<p><u>Obtain documentation of</u> Provide <u>DRCDWMRC</u> notification. Document lift area, location, thickness, and compaction on the Lift Approval Form.</p>	<p><u>Notify DRCDWMRC or DSHW (by email) that the final surface is ready for inspection. Provide QC with documentation of DRCDWMRC or DSHW inspection and approval.</u> Periodically observe lift approval documentation.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – TEMPORARY COVER PLACEMENT AND MONITORING

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>adjacent top slope area has reached the top of waste elevation all top slope and adjacent side slope areas shall have temporary cover placed within 90 calendar days.</p> <p>Temporary cover shall be a minimum of 1 foot thick. Temporary cover may be over-built in order to achieve this thickness. Temporary cover shall be placed in accordance with the lift thickness and compaction requirements specified under Work Element Waste Placement, above. Contaminated equipment may be used to place temporary cover.<u>Specifications 74 and 75.</u></p> <p>The edge of the temporary cover shall be marked with fencing, rope, snow fence, or equivalent marking to prevent heavy equipment travel on the temporary cover surface. Haul routes may traverse temporary cover, provided that the haul route does not travel over any pre-final cover<u>interim</u> settlement monuments and that the haul route is marked with fencing, rope, snow fence, or equivalent markings. Temporary cover may encroach up to 5 feet into the offset for the run-off berm.</p> <p>A commercial fixative product, magnesium chloride, or clean water may be applied to the surface of the temporary cover to aid in dust control and erosion prevention. Contaminated water shall not be used for dust suppression on temporary cover. Erosion control blankets, mats, or fiber mulch may also be used, in accordance with the manufacturer's instructions, for erosion prevention.</p> <p>DRC<u>DWMRC</u> shall be notified at least 48 hours prior to deployment of erosion control blankets,</p>	<p><u>Obtain documentation of Provide</u>DRC<u>DWMRC</u> notification. Document application and removal of erosion control materials on the Daily Construction Report.</p>	<p><u>Notify DRCDWMRC at least 48 hours prior to deployment of erosion control blankets, mats, or fiber mulch. Provide QC with documentation of DRCDWMRC notification.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – TEMPORARY COVER PLACEMENT AND MONITORING

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
mats, or fiber mulch. If used, such erosion control materials shall be removed prior to radon barrier construction.		
<p>127) PRE-FINAL COVER SETTLEMENT MONUMENTS: <u>Prior to cover construction, Interim Pre-final cover</u> settlement monuments <u>will be constructed on top of the waste. Interim settlement monuments</u> shall consist of approximately 18-inch long #5 or greater rebar that is welded to a metal plate. The metal plate shall be approximately 18 inches square with a thickness of 3/16 inch to 1/4 inch. The metal plate shall be placed on the top of waste surface and then secured by the temporary cover as it is placed. Each monument shall be labeled, flagged, <u>surveyed</u>, and documented <u>on a reference drawing</u>.</p>	Inspect interim pre-final cover settlement monuments for compliance with the specification prior to installation.	Perform a surveillance of <u>interim settlement</u> monument installation activities.
<p>128) PRE-FINAL COVER INTERIM SETTLEMENT MONUMENT PLACEMENT: Pre-final cover <u>Interim</u> settlement monuments shall be placed as close as practical to the locations of final cover settlement monuments identified in Figures 2 and 4. In addition, pre-final cover <u>Interim</u> settlement monuments shall be placed at the locations identified as <u>“temporary cover settlement monuments” on Figure 2 and “additional final temporary cover monuments” on Figures 2 and 4</u>.</p>	Perform and document a post-construction survey of the <u>location of the</u> pre-final cover settlement monuments.	Verify that surveys have been performed <u>and documented</u> .
<p>129) SURVEY REQUIREMENTS: Surveys shall be performed with GPS or approved equivalent equipment. Tolerance shall be no more than ± 0.1 foot.</p>	Calibrate and Operate survey equipment in accordance with the manufacturer’s recommendations. <u>Verify equipment accuracy with a known benchmark.</u>	
<p>130) SURVEY INTERVAL: The pre-final</p>	Perform and document the required surveys. Provide	Verify that <u>interim settlement</u> monument surveys are

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – TEMPORARY COVER PLACEMENT AND MONITORING

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>cover<u>interim</u> settlement monuments shall be surveyed within 30 days of temporary cover installation. New monuments shall be surveyed again during the months of January, March, May, July, September, and November<u>at least once each quarter and at least two months from the previous survey</u>during the months of January, March, May, July, September, and November. After at least one year of data has been obtained for a monument, it shall be surveyed semi-annually during the months of May and November until final cover construction begins. Weather conditions at the time of the survey and a discussion of the potential for frost to be present shall be documented in the survey report.</p>	<p>survey data to the Director of Engineering<u>Manager, Engineering and Maintenance</u>Engineering Manager.</p>	<p>completed <u>and documented</u> as required.</p>
<p>131) INSPECTIONS: Monthly, inspect temporary cover for the presence of erosion gullies. If the inspection indicates that waste material is exposed due to erosion, the temporary cover shall be repaired in that area within seven<u>7</u> calendar days.</p>	<p>Perform and document monthly inspections.</p>	<p><u>Verify monthly inspections were completed and documented.</u></p>
<p>Semi-annual<u>Annually by July 1 of each year</u>, maintain the temporary cover surface. Maintenance shall consist of filling in <u>and compacting</u> any erosion gullies and, if necessary, re-grading to prevent ponding on the temporary cover.</p>	<p>Document semi-annual maintenance activities. Document any areas requiring filling or re-grading.</p>	<p><u>Verify that annual temporary cover maintenance activities were completed and documented.</u></p>
<p>132) REPORTING: Survey data for pre-final<u>cover</u><u>interim</u> settlement monuments shall be compiled and analyzed to evaluate total and differential settlement. This data and analysis shall be submitted to DRC<u>DWMRC</u> with the annual as-built report.</p>		
<p>Review and analysis of <u>interim</u> settlement monitoring<u>monitoring-monument</u> data will include the</p>		

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – TEMPORARY COVER PLACEMENT AND MONITORING

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>following:</p> <ul style="list-style-type: none"> • A drawing identifying the location of each interim settlement monumentsurveyed point, • Graphical or tabular presentation of the incremental settlement for each point monument (how much each point-monument has moved since the last set of readings), • Graphical or tabular presentation of the total settlement for each pointmonument, • Graphical or tabular presentation of the time rate of settlement for each point-monument (to include both the overall rate from the first data for the pointmonument, and the incremental rates for each period), • Graphical or tabular presentation of the differential settlement for each point-interim settlement monument with respect to the nearest adjacent interim settlement monument points, and • A discussion about the general nature of the observed settlement, and any areas of the landfill that are behaving in an anomalous manner. <p>133) TRANSITION TO FINAL COVER: If distortion is less than 0.007 foot/foot for all of the grid points in a given area, between adjacent interim settlement monuments, and each interim settlement monument-grid point has at least one year's monitoring data; then final cover construction may proceed. The Engineering Manager shall make this evaluation from pre-finalinterim-cover settlement data. If the criteria are met, a written report shall be prepared and forwarded to DRCDWMRC at least seven7 calendar days prior to removing the pre-final</p>	<p>Obtain documentation of DRCDWMRC notification at least seven calendar days prior to removing the pre-final-coverinterim settlement monuments. The Director of Engineering shall evaluate pre final cover settlement data for each area of cover construction to determine distortion between all adjacent points in that area. If the criteria are met, a written report shall be prepared and forwarded to DRC at least 7 calendar days prior to removing the pre-final cover settlement monuments.</p>	<p>Verify that QC has obtained documentation of DRCDWMRC notification.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – TEMPORARY COVER PLACEMENT AND MONITORING

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>cover<u>interim</u> settlement monuments. Final cover construction shall be completed within three years of interim settlement monument removal over that specific area.</p> <p>Once an area is approved, final cover construction shall be completed within 3 years of this determination.</p> <p>The Director of Engineering shall perform the analysis of projected future distortions. The analysis shall be submitted no later than the end of the 16th year since waste placement began in the oldest lift area subject to analysis.</p> <p>If an area is not approved for final cover construction by the end of the 16th year of the 18-year open cell period, an analysis of projected future distortions shall be performed and submitted to DRC. The analysis shall evaluate settlement through the end of year 17 of the open cell period, at a minimum. If the analysis indicates that the future distortions between any two adjacent points will be more than 0.007 foot/foot, then surcharging over the area(s) in question will be required to stabilize settlement prior to final cover construction. If surcharging is required, a plan and schedule shall be provided to DRC by the end of the 16th year of the open cell period. The surcharging schedule shall show that surcharging will be complete by the end of the 17th year of the open cell period. Settlement monitoring frequency during surcharging shall be at least equivalent to that required in Year 16.</p> <p><u>If an area is not approved for final cover construction by the end of the 16th year of the 18-year open cell period, an analysis of projected future distortions shall be performed and submitted to the DWMRC. The analysis shall evaluate potential settlement through the end of</u></p>	<p>Inspect and document that all <u>pre-final-cover-interim</u> settlement monuments have been removed prior to final cover construction.</p> <p>Survey and document the <u>top of</u> temporary cover surface <u>on a 50 foot grid and at key points (i.e., embankment break lines)</u> to confirm that the <u>top of waste</u>—design <u>grade</u>and elevations are <u>not exceeded</u><u>achieved</u>.</p>	<p>Verify that <u>pre-final-cover</u><u>interim</u> settlement monuments have been removed, and</p> <p><u>Verify</u> that the temporary cover surface <u>does not exceed—meets</u> design <u>top of waste grades and</u> elevations.</p> <p><u>Verify that documentation is complete.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – TEMPORARY COVER PLACEMENT AND MONITORING

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p><u>year 17 of the open-cell period, at a minimum. If the analysis indicates that the future distortions between any two adjacent pointsmonuments will be more than 0.007 foot/foot, then additional engineering analyses will be done and a plan to stabilize settlement prior to final cover construction provided to the DWMRC. The plan to stabilize settlement shall accomplish set goals prior to the open cell time limit.</u></p> <p>Immediately prior to placement of the first lift of radon barrier, the pre-final cover<u>interim</u> settlement monuments shall be removed and the temporary cover surface restored.</p> <p><u>Top of temporary cover elevations shall be at or below design elevations.</u> Additional clean debris-free soil material shall be placed; or excess temporary cover material shall be cut, as needed to return the area for final cover construction to the original top of waste design grades and elevations.</p> <p>When placing clean debris-free soil material for this purpose, the soil shall be placed in lifts with a compacted average thickness not exceeding 12 <u>inches</u>” and compacted to 90 <u>percent</u>% of a standard Proctor. If an area has settled more than 12 <u>inches</u>”, bulk waste may be placed in accordance with the applicable work elements and specifications of this manual, so long as at least 1 <u>foot</u>ft of temporary cover is in place prior to radon barrier construction.</p> <p><u>DRCDDWMRC</u> shall be notified at least 48 hours in advance of the start-up of temporary cover removal in previously placed areas.</p>	<p>Document lift thickness and compaction for any debris free soil temporary cover material placed to bring the temporary cover surface to the design top of waste grades and elevations.</p> <p><u>Obtain documentation of</u>Provide <u>DRCDDWMRC</u> notification of pending temporary cover removal. Document the lift area and location on <u>the</u>a Daily Construction Report.</p>	<p><u>Notify DRCDDWMRC at least 48 hours in advance of temporary cover removal. Provide QC with documentation of DRCDDWMRC notification.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – TEMPORARY COVER PLACEMENT AND MONITORING

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
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LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER BORROW MATERIAL

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
134) SCOPE: This work element applies to the Class A West and 11e.(2) embankments.		
135) CLEARING AND GRUBBING: Remove vegetation, debris, organic, or deleterious material from areas to be used for borrow. Grubbing depth will depend on the type of vegetation, debris, organic, or deleterious material on the site. If the area is free of these materials then no clearing and grubbing will be necessary.	Inspect the area once clearing and grubbing has been completed. Record observations and corrective action (where required) on the "Daily Construction Report" <u>Daily Construction Report</u> .	Verify that the clearing and grubbing has been inspected <u>and documented</u> by QC.
136) MATERIAL--NATURAL CLAY MIXTURE: Satisfactory material shall be defined as CL and ML, or CL-ML soils based on the Unified Soil Classification <u>with at least 85 percent passing the No. 200 sieve (silt and clay), a plasticity index (PI) between 10 and 25, and a liquid limit (LL) between 30 and 50 with at least 85 percent passing the No. 200 sieve (silt and clay), a plasticity index (PI) between 10 and 25, and a liquid limit (LL) between 30 and 50. The clay shall also have a dry clod size less than or equal to one inch.</u>	Perform laboratory classification tests (<u>ASTM D 2487</u>) at a rate of one <u>+</u> test per lot prior to use of material in the radon barrier. A lot is defined as a maximum of 53,000 cubic yards (compacted) of specified material type. Record the location of the classification sample on the "Sample ing Log". a. Approve lots (which meet the specified classification) for use in the radon barrier. b. Lots not meeting the specified classification can not be used.	Verify <u>that</u> the frequency of laboratory tests <u>is in compliance with the specification and compliance of test results.</u>
137) PROTECTION: The borrow material will be handled in such manner as to prevent contamination with radioactive waste material or other deleterious material. The in-place <u>Acceptable</u> material may contain up to five <u>5</u> percent additional rocks (<u>less than or equal to one inch</u>) and sand above the content found in the classification test.	Visually check radon barrier materials for contamination by foreign materials <u>in accordance with ASTM D2488</u> . Remove <u>or rework</u> clays that have been contaminated above the specified requirements. Document corrective actions (where required) on the "Daily Construction Report" <u>Daily Construction Report</u> .	Verify that the radon barrier is being inspected for contaminants and that <u>the inspection and</u> corrective actions (if required) are properly documented.
138) PROCESSING: These procedures may be used to provide suitable material for construction of the radon barrier.		
A. If used, <u>a</u> Apply deflocculant at a rate	Measure the <u>size of the</u> mixing areas and verify that the	Verify that the size of the mixing areas and the amount

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER BORROW MATERIAL

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>determined by the production engineer<u>Manager, Engineering and Maintenance</u>Engineering Manager.</p> <p>2</p> <p>B. Mix the deflocculant thoroughly into the soils by tilling, or similar action.</p>	<p>application rate of the deflocculant is equal to or greater than the rate determined by the production engineer<u>Manager, Engineering and Maintenance</u>Engineering Manager. Record the size of the mixing areas and the amount of deflocculant applied on the "Embankment Construction Lift Approval Form".</p> <p>Observe the mixed clay and advise<u>notify</u> the Project Manager of areas which are adequately mixed.</p>	<p>of deflocculant applied have<u>has</u> been properly documented.</p> <p>Verify that the clay is being inspected <u>correctly and documented</u> by QC.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER TEST PAD

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>139) SCOPE: This work element applies to the Class A West and 11e.(2) embankments.</p>		
<p>140) NOTICE OF TEST PAD CONSTRUCTION: The <u>radon barrier</u> test pad plan shall be approved <u>provided to approved by</u> the <u>DRCDWMRC</u>. The radon barrier test pad plan shall be <u>provided to the DWMRC at least 14 calendar days</u> prior to test pad construction. <u>If DWMRC has not provided approval or deficiency notification prior to the end of 14 calendar days, construction may proceed as proposed in the test pad plan.</u> The DRCDWMRC shall be notified 2448 hours in advance of the start up of test pad construction.</p> <p><u>The DWMRC shall be notified 48 hours in advance of the start-up of test pad construction.</u></p>	<p>Obtain documentation confirming that the test pad plan has been approved by <u>provided to approved by</u> the <u>DRCDWMRC</u> or the 14 calendar day period has ended. Verify that the DRCDWMRC has been notified as required. Obtain documentation confirming that the of DRCDWMRC has been notified as required. notification.</p> <p><u>Obtain documentation confirming that the DWMRC has been notified as required.</u></p>	<p>Verify that the test pad plan has been approved by <u>provided to</u> the <u>DRCDWMRC</u> at least 14 calendar days prior to construction of the test pad. Verify that the DRCDWMRC has been notified as required. Notify the DRCDWMRC at least 48 hours in advance of the start up of test pad construction. Provide QC with documentation of DRCDWMRC notification approval or documentation that the 14 calendar day period has expired.</p> <p><u>Notify the DWMRC at least 48 hours in advance of the start-up of test pad construction. Provide QC with documentation of DWMRC notification.</u></p>
<p>141) TEST PAD(S): An approximately test pad with minimum dimensions of 60 feet by 75 feet large test pad will be constructed using the procedure proposed for construction of the radon barrier. when using heavy equipment for compaction</p> <p><u>Prior to use of manually operated compaction equipment, a small test pad with minimum dimensions of five feet by five feet (sized appropriately for the equipment used) will be constructed. The purpose of this small test pad is to establish equipment and procedures for construction of <u>clay liner</u> radon barrier in locations where large equipment is not practical (e.g. repairs). If manually operated compaction</u></p>	<p>Observe the construction of test pads. Measure test pads to ensure that they are constructed to the size indicated. Record the test pad size on the "Embankment Construction Lift Approval Form".</p> <p>The large test pad shall be divided into three lots per lift (approximately 1,500 square feet per lift). Each lift of the small test pad shall equal a lot.</p>	<p>Observe the construction of the test pads. Verify that the test pad has been measured and is properly documented.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER TEST PAD

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>equipment is not used on the project, a small test pad is not required.</p> <p>-.If necessary, aAn approximately 5 feet by 5 feet small test pad will be constructed using the procedure proposed for construction of the radon barrier when using hand compaction equipment.</p> <p>A new <u>radon barrier</u> test pad shall be constructed each time there is a significant change in specifications, construction procedures, <u>unified soil classification, or</u> types of equipmentunified soil classification, QC testing equipment or procedure. A new test pad must be constructed each time there is a change in the grade or source of bentonite.</p> <p><u>Radon barrier Test-test</u> pads are to be constructed and tested in accordance with the following specifications:</p> <p>A. <u>Prior to compaction, conduct at least one classification and gradation test for each test pad.</u></p> <p>B. <u>Place the clay in at least three lifts with the first lift uncompacted thickness not exceeding twelve inches. Remaining lifts shall have a loose material thickness not exceeding nine inches for each lift.</u></p> <p>A.C. <u>The clay material will be inspected forhave a dry clod size during placement of each lift of radon barrierless than or equal to one inch.</u></p>	<p><u>Conduct classification and gradation tests (as described in Appendix B) at a rate of one of each type of test per test pad.</u></p> <p>Measure the lift thickness at a rate of one<u>1</u> test per lot. Record thickness on the "Embankment Construction Lift Approval Form".</p> <p>Inspect the loose clay material during the unloading and spreading process for each uncompacted lift to ensure any dry clods that are present are less than or equal to one (+)<u>1</u>-inch. <u>Notify the Project Manager to have operations remove clods greater than one inch.</u> Record inspection of the dry clod size on the "Embankment Construction Lift Approval Form" <u>and re-inspect the uncompacted lift if necessary. Record any corrective actions performed on the Daily Construction Report.</u></p> <p><u>Record type of equipment used, and number of passes on the Embankment Construction Lift Approval Form.</u></p> <p>Verify with the Project Manager that the same or similar type equipment and compaction efforts will be</p>	<p><u>Verify the frequency of tests and compliance of test results.</u></p> <p>Verify that the number of lifts and lift thicknesses has<u>have</u> been documented. Verify that the clod size inspection has been performed and documented for each uncompacted lift thickness.</p> <p><u>Verify that the dry clod size inspection has been performed and documented, including corrective actions as necessary.</u></p> <p>Review documentation and v<u>Verify equipment used and the number of passes made in preparing the test pad are those to be used during the construction of the radon barrier.</u></p> <p><u>Perform a minimum of one visual inspection per test pad.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER TEST PAD

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>B-D. <u>2.</u> The clay is to be placed and compacted by equipment proposed for use during construction of the radon barrier.</p> <p>3 The lifts of clay shall be bonded by ÷</p> <p>a) P providing a rough upper surface on the underlying layer of radon barrier. The surface should have changes in grade of approximately one inch or more at a rate of two <u>or more</u> per linear foot.÷</p> <p>OR</p> <p>C-E. By compacting with a sheepsfoot with feet approximately two inches longer than the lift thickness.</p> <p>D-F. The clay is to be compacted to at least 95 percent of a standard Proctor with a moisture content between three one-half a percentage points below optimum and five percentage points of optimum to 5 percent over optimum. Compaction of the large test pad is to be accomplished by at least four passes of suitable compaction equipment.</p>	<p>used in the cell for construction of the radon barrier. Record type of equipment used, and number of passes on the "Embankment Construction Lift Approval Form". Perform a visual inspection to <u>Verify</u> verify that there are adequate changes in grade. <u>Any areas of concern shall be verified</u> by placing a straight edge at least two feet long on the surface <u>and counting.</u> Count the number of points approximately one inch or more below the straight edge. <u>Notify the Project Manager of any deficiencies. Re-inspect after the Project Manager has corrected deficiencies.</u></p> <p style="text-align: center;">OR</p> <p>Verify that the feet on the sheepsfoot compactor are approximately two inches longer than the lift thickness. Conduct in-place moisture-density tests at a rate of one test per lot per lift. The test location shall be chosen on the basis of random numbers (described in Specification 12). Record the test result on the "Field Density Test" form.</p> <p>a. Approve lots which meet the specified moisture and compaction.</p> <p>b. <u>Notify the Project Manager of lots not meeting the specified</u> permeability <u>moisture and compaction to have the areas reworked.</u></p> <p>b.c. Retest (moisture/density and permeability) lots after rework has been completed. Rework and retest lots not meeting the specified moisture or compaction.</p> <p><u>ed.</u> Any additional work under b. shall be included in the test pad construction method.</p> <p>Conduct in-place permeability tests at a rate of one test per lot per lift. The permeability test shall be run in close proximity to the moisture-density test. Record the test result on the "Field Permeability Test" form.</p> <p>a. Approve lots that meet the specified permeability.</p>	<p>Verify the frequency of measurements and compliance of test results.</p> <p><u>Review documentation and v</u> vVerify the frequency of tests and compliance of test results.</p> <p>Verify the frequency of tests and compliance of test results.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER TEST PAD

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>G. 5. The clay is to be constructed to provide a permeability of less than or equal to the specified permeability as shown on the approved engineering drawings <u>listed in Groundwater Quality Discharge Permit UGW450005</u>. Permeability testing on the bottom lift will be performed at the surface. Permeability on the second lift will be performed <u>≥ greater than or equal to 2 two inches</u> below the surface. Permeability on the third lift will be performed <u>≥ greater than or equal to 4 four inches</u> below the surface.</p> <p>6. At least one PI, LL, and gradation tests shall be conducted for each test pad.</p> <p>E.H. 7. The procedures used to construct the test pad shall be reviewed and approved by the certifying engineer. The test must be approved by a Utah licensed Professional Engineer.</p> <p>F.I. 8. The <u>test pad certification report shall be provided to approved by procedures used to construct the test pad shall be reviewed and approved by the DRC DWMRC</u> prior to using the new test pad construction method. <u>However, if the DWMRC has not provided approval or deficiency notification prior to the end of 14 calendar days from the time the certification report was submitted, construction may proceed using the new construction method.</u></p>	<p>b. <u>Notify the Project Manager of lots not meeting the specified permeability to have the areas reworked.</u></p> <p>b.c. <u>Retest (moisture/density and permeability) lots after rework has been completed. Rework and retest lots not meeting the specified permeability</u></p> <p>ed. Any additional work under b. shall be included in the test pad construction method.</p> <p>Conduct PI, LL, and gradation tests at a rate of one of each type of test per test pad.</p> <p>Provide the certifying <u>Utah licensed Professional Engineer</u> with copies of the documentation for the test pad for review and approval.</p> <p><u>Obtain documentation confirming that the test pad certification report has been approved by the DWMRC or the 14 calendar day period has ended. Obtain documentation confirming the DRC approval of the test pad.</u></p>	<p>Verify the frequency of tests and compliance of test results.</p> <p>Verify that the PI, LL, and gradation tests have been conducted and documented.</p> <p>Verify that proper approval has been obtained for the test pad and that the necessary construction procedure documents are in place for use during radon barrier construction.</p> <p><u>Verify that the test pad certification report has been provided to the DWMRC. Provide QC with documentation of DWMRC approval or documentation that the 14 calendar day period has expired. Verify that proper approval has been obtained for the test pad and that the necessary construction procedure documents are in place for use during radon barrier construction.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
142) SCOPE: This work element applies to the Class A West and 11e.(2) embankments.		
143) NOTICE OF COVER CONSTRUCTION: The DRC DWMRC shall be notified of the cessation of waste placement and the start-up of cover construction for each phase of the "cut and cover" operation cover construction .	<u>Obtain documentation of DRC/DWMRC notification.</u> Verify that the DRC has been notified of the anticipated cessation of waste placement and the start-up of cover construction, prior to the placement of radon barrier.	Verify that the DRC has been notified prior to the placement of radon barrier. <u>Notify the DRC/DWMRC of start-up for each phase of cover construction. Provide QC documentation of DRC/DWMRC notification.</u>
144) PROJECT AREA: Radon barrier projects shall have a minimum total area of 300,000 square feet, unless otherwise approved in advance, in writing by DWMRC. Radon barrier projects may continue over more than one construction season, so long as the specifications for cold weather placement and spring start-up are met (Specifications 156 and 157). A radon barrier project may consist of any number of lift areas. The project area shall be documented in plan drawings.		
145) LIFT IDENTIFICATION: Each lift shall be given a <u>unique lift identification number</u> discrete designation for testing and surveying purposes.	Assign a lift identification number to each lift. Use the lift identification number to identify all paper work for that lift.	Verify that a lift identification number has been assigned to each lift. Verify that the lift identification number is used on all paper work for that lift.
146) PLACEMENT: The radon barrier will be prepared, placed and compacted using the same type of equipment and mixing and compacting procedures that were approved in the test pad (<u>Specification 139</u> 41).	Observe the radon barrier placement. Record the equipment used to place the radon barrier, along with any corrective actions (where required) on the " <u>Daily Construction Report</u> " "Daily Construction Report" .	Verify the equipment used to construct the radon barrier has been documented and that it is the same type of equipment used to construct the test pad.
147) LIFT BONDING: The lifts of clay shall be bonded by providing a rough upper surface on the underlying layer of radon barrier. The surface should have changes in grade of approximately one inch or more at a rate of two per linear foot. -OR-	<u>Perform a visual inspection to v</u> Verify that there are adequate changes in grade. <u>Any areas of concern shall be verified</u> by placing a straight edge at least two feet long on the surface <u>and counting</u> . Count the number of points approximately one inch or more below the straight edge. <u>Notify the Project Manager of any</u>	Verify the frequency of measurements and compliance of test results.

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>2) By compacting with a sheepsfoot with feet approximately two inches longer than the lift thickness.</p> <p>148) LIFT THICKNESS: The first lift of material shall have an uncompacted thickness of no greater than 12 inches. For the remaining lifts, the loose lift thickness shall not exceed the lesser of the lift thickness used to construct the test pad or nine inches.</p> <p><u>A.</u> Thickness for the lift will be established by installing grade poles on at least a 70-foot grid and at all control points <u>(at a minimum, each corner of the area; also at break lines)</u>. The grade poles must not be installed deeper than <u>one+</u> inch into the underlying clay liner. The grade poles must be marked at the appropriate depth to establish the grade. After the grade for the lift has been checked and approved by QC personnel, the grade poles shall be removed.<u>The clay material will be inspected for dry clod size during placement of each lift of radon barrier.</u></p> <p style="text-align: center;">- OR -</p> <p><u>B.</u> <u>Survey to determine lift thickness. Survey equipment shall have a tolerance no more than ± 0.1 foot.</u></p> <p>The clay material shall have a dry clod size less than or equal to one inch.</p>	<p><u>deficiencies. Re-inspect the surface after corrective actions have been completed. Document any deficiencies and corrective actions taken on the Daily Construction Report.</u></p> <p>-OR-</p> <p>Verify that the feet on the sheepsfoot compactor are approximately two inches longer than the lift thickness.</p> <p>Verify that the required grading tolerance is achieved as follows:</p> <ol style="list-style-type: none"> Ensure that the required frequency for placement of grade poles has been met. Compare soil level with the marked level on the grade poles. <u>Visually check</u> Use a string line where necessary between poles to check for high or low spots. Define out of specification areas and <u>advise-notify</u> the Project Manager to rework those areas. Review areas reworked and approve areas meeting criteria. Continue "b" through "d" above until all areas meet criteria. Indicate areas meeting criteria in the "Embankment Construction Lift Approval Form". <p style="text-align: center;">- OR -</p> <ol style="list-style-type: none"> <u>Verify survey equipment is within a tolerance of ± 0.1 foot</u>equipment calibration. <u>Verify correct set-up and operation of equipment.</u> <u>Document survey results on a survey report.</u> <p>Dig a hole and measure the loose lift thickness at a rate of one per lot. A lot is defined as 10,000 square feet of a single lift and record on the "Lift Approval Form". The location of the measurement shall be chosen on the basis of random numbers.</p>	<p><u>Verify the frequency of measurements and compliance of test results.</u>Observe, at a minimum, five percent of the measurements performed by the QC personnel to ensure that the measurements are being performed correctly. Verify that the measurements are being performed at the correct frequency and that the documentation is being completed. Verify that the clod size inspection has been performed and documented for each uncompacted lift.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
	<p>a. Approve lots which meet the specified lift thickness.</p> <p>b. If the thickness is greater than the specified thickness, measure the thickness at four points (north, east, south, and west) within ten feet of the first measurement. Average the five measurements together.</p> <p>c. Approve lifts with an average less than or equal to the specified lift thickness.</p> <p>d. Rework and retest lots with an average lift thickness greater than the specified lift thickness.</p> <p>Inspect the loose clay material during the unloading and spreading process for each uncompacted lift to ensure any dry clods that are present are less than or equal to one (1) inch. Record inspection of the clod size on the "Embankment Construction Lift Approval Form".</p> <p><u>Inspect the loose clay material during the unloading and spreading process for each uncompacted lift to ensure any dry clods that are present are less than or equal to one inch. Notify the Project Manager to have operations remove clods greater than one inch. Record inspection of the clod size on the Embankment Construction Lift Approval Form and re-inspect the uncompacted lift. Record any corrective actions performed on the Daily Construction Report.</u></p>	
<p>149) KEYING-IN: Segments of cell radon barrier constructed at times more than 30 days apart than each other shall be keyed-in to each other <u>by one of the following methods:</u></p> <p><u>A. Key-in vertical steps no greater than nine inches and at least twice as wide as they are high.</u></p> <p style="text-align: center;">- OR -</p>	<p>Verify that the new liner has been properly keyed-in to the existing liner. Record deficiencies on the "Embankment Construction Lift Approval Form".</p>	<p>Verify that the keying-in of the liner has been documented.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p><u>B. Slope the full thickness of old radon barrier at a maximum slope of 5:1 at vertical steps no greater than nine inches and at least twice as wide as they are high.</u></p> <p><u>The surface shall be maintained in accordance with the Radon Barrier Drying Prevention specification below Specification 1524.</u></p>		
<p>150) COMPACTION: Radon barrier material will be compacted to at least 95 percent of standard Proctor with a moisture content <u>between 3 one-half a percentage points below optimum and 5 five percentage points between optimum and 5 percent over optimum.</u></p>	<p>Conduct in-place moisture-density tests at a rate of one test per lot and record the results on the Field Density Test form. A lot is defined as 4000<u>500</u>200 cubic yards (compacted) of a single lift. The test location shall be chosen on the basis of random numbers <u>(described in Specification 12).</u></p> <ol style="list-style-type: none"> Approve lots which meet the specified moisture and compaction. Rework and retest lots not meeting the specified moisture or compaction. <p>Proctors shall be performed at a rate of one test per borrow lot. A borrow lot is defined as 3,000 cubic yards (compacted) or less of a specific material type. Record the location of the Proctor sample on the "Sampling Log".</p>	<p><u>Visually observe at least one in-place moisture-density test per project area. Verify that the tests are being performed at the correct frequency and that the documentation is being completed. Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.</u></p>
<p>151) PERMEABILITY: The radon barrier shall have an in-place permeability of less than or equal to 1×10^{-6} cm/sec for the bottom layer. The radon barrier shall have an in-place permeability of less than or equal to 5×10^{-8} cm/sec for the final top foot.</p>	<p><u>Conduct in-place permeability tests at a rate of one test per lot and record the results on the Field Permeability Test form. A lot is defined as 2,000 compacted cubic yards of 1×10^{-6} cm/sec radon barrier or 5×10^{-8} cm/sec radon barrier. The permeability test shall be run in close proximity to within five linear feet of a moisture-density test location.</u></p> <ol style="list-style-type: none"> <u>Approve lots which meet the specified permeability.</u> <u>Notify the Project Manager of lots not meeting the specified permeability to have the areas reworked.</u> 	<p><u>Visually observe one lift being compacted per construction season. Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
	<p>c. <u>Retest (moisture/density and permeability) lots after rework has been completed.</u></p> <p>b. Rework and retest lots not meeting the specified permeability.</p> <p>ed. Restore all test areas to assure no leaks. Permeability is verified by strict adherence to the test pad construction method and equipment. Observe compaction activities to ensure that the minimum number of passes are completed by the appropriate equipment. Conduct in place permeability tests at a rate of one test per lot and record the results on the "Field Permeability Test" form. A lot is defined as 2,000 cubic yards (compacted) of 1×10^{-6} cm/sec or 200 cubic yards (compacted) of 5×10^{-8} cm/sec radon barrier. The permeability test shall be run in close proximity to a moisture density test location.</p> <p>a. Approve lots that meet the specified permeability.</p> <p>b. Rework and retest lots not meeting the specified permeability.</p> <p>c. Restore all test areas with the approved construction method.</p>	
<p>152) LAYER THICKNESS: For the LLRW-CAW embankment, the bottom (1×10^{-6} cm/sec permeability) layer shall be at least 1.0 feet-foot thick. For the 11e.(2) embankment top slopes, the bottom (1×10^{-6} cm/sec permeability) layer shall be at least 3.0 feet thick. For the 11e.(2) embankment side slopes, the bottom (1×10^{-6} cm/sec permeability) layer shall be at least 2.5 feet thick. For the LLRW-CAW and 11e.(2) embankments, the top (5×10^{-8} cm/sec permeability) layer shall be at least 1.0 feet-foot thick.</p>		
<p>153) LINER TRANSITIONS BETWEEN</p>	<p>Survey the radon barrier surface on a 50 footft grid and</p>	<p>Review the final survey data. Verify the frequency of</p>
<p>REVISION: 26d<u>27aXX</u></p>	<p>page 106 of 138</p>	<p>Date: May 7<u>October 25, 2012</u>XXXX</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
RADON BARRIERS WITH DIFFERENT SPECIFIED PERMEABILITIES: The radon barrier with the higher permeability (i.e. the bottom radon barrier) shall be final graded from <u>design elevation grade</u> to 0.4 feet below <u>grade</u> design <u>elevation</u> <u>grade</u> . Survey on a 50 <u>foot</u> <u>ft</u> grid and key points: <u>(i.e., embankment break lines)</u> .	at key points. Final survey measurements will be documented and provided to the <u>QC Supervisor and Quality Assurance, QC Officer/Lead, QC Embankment Construction and Construction QA Officer.</u> a. Indicate where the radon barrier meets design line and grade. b. Rework and resurvey areas not meeting the specified grade.	the survey points.
154) RADON BARRIER DRYING PREVENTION: To prevent the radon barrier from drying, water will be applied to the clay surface on an as needed basis or the radon barrier will be covered with <u>six</u> <u>6</u> inches of loose clay. Finished radon barrier shall be covered with 12 inches <u>of filter zone, sacrificial soil the next design layer, or 6-six</u> inches of loose clay within 30 days of completion. Unfinished radon barrier shall be covered with <u>six</u> <u>6</u> inches of loose clay within 30 days of the last activity for the lift. Desiccation cracks larger than one-fourth inch wide and <u>three</u> <u>one</u> inches deep in the radon barrier will be reported to the <u>DRCDWMRC</u> and will be documented as a non-conformance item when discovered.	Observe the liner surface for drying. <u>Advise-Notify the Project Manager of any desiccation cracks larger than one-fourth inch wide and three-inches deep in the clay liner. Retest reworked/repaired areas in accordance with Specification 14850. the compaction specification above. deficiencies</u> Record corrective actions taken (where required) on the <u>"Daily Construction Report"</u> <u>Daily Construction Report.</u>	Verify that the liner is being inspected <u>correctly and the inspection documented. Notify the DRCDWMRC of non-conformance items, as required. -</u>
155) SNOW REMOVAL: When radon barrier material is to be placed and the work area is covered with snow, the snow must be removed <u>without damaging approved radon barrier.</u>	Observe that snow is removed. <u>Inspect radon barrier for damage. Advise-Notify the Project Manager of deficiencies/damage. Re-inspect after the Project Manager has corrected deficient/damaged areas. Construction may not continue without taking corrective actions to remove the snow.</u> Record corrective actions (where required) in the <u>"Daily Construction Report"</u> <u>Daily Construction Report.</u>	Verify that snow removal is being documented <u>and the radon barrier had been inspected.</u>
7)156) COLD WEATHER PLACEMENT OF RADON BARRIER: For purposes of this	As needed, observe the area where radon barrier is to be placed. If frozen material is observed, cease	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>CQA/QC Manual, “frozen” is defined as a soil temperature of less than or equal to 27°F. Radon barrier shall not be placed above frozen material. In addition, no frozen material shall be processed or placed.</p> <p>If the air temperature has dropped below 32°F since the last lift of radon barrier was approved, one of the following three scenarios apply:</p> <p>A. (1)-If less than 30 days have passed since the date of lift approval and the last lift of radon barrier has been covered since the approval date with at least <u>nine</u>9 inches of loose clay or <u>six</u>6 inches of compacted clay, then the cover clay may be worked with no additional testing of the lower approved lift.</p> <p>B. (2)-If less than 30 days have passed since the date of lift approval and the last lift of radon barrier has not been covered with at least <u>9</u>nine inches of loose clay or <u>6</u>six inches of compacted clay, then:</p> <p>(a)1.- Perform spring start-up testing as discussed below; or</p> <p>(b)2.- Measuremonitor the radon barrier temperature approximately <u>one</u>4 inch beneath the surface <u>at a frequency of one measurement per lot (defined as no more than 100,000 square feet)</u>. If the temperature <u>one</u>4 inch beneath the surface is greater than 27°F, re-roll the surface with one pass of the same type of construction equipment (i.e., a compactor for intermediate lifts or a smooth drum roller for the final surface) and continue with radon barrier construction. If the</p>	<p>placement of radon barrier. If frozen material is suspected, measure soil temperature. Record the stopping of placement in the “Daily Construction Report.”</p> <p>Review ambient air temperature records as measured at the site meteorological station. Document status of radon barrier cover placement on the “Daily Construction Report.” MeasureMonitor radon barrier temperature when triggered under 2.(b)-B.2. of this specification at the design frequency. Clay temperature shall be measured between 6:00 amAM and 8:00 amAM on the day that radon barrier will be placed. Temperature measurements shall include a location that is most likely to be coldest; i.e., if there is a portion of the radon barrier that is shaded or at a low point.Temperature monitoring frequency shall be at least one point per 100,000 square feet or one point per contiguous project area, whichever is smaller. To ensure a stable reading, the temperature probe shall be left in place for at least two minutes prior to taking the reading.</p> <p>If the initial radon barrier temperature measurement is less than or equal to 27°F, the affected area may be resampled before 8:30 amAM the same day as follows:</p> <p>a. Measure the radon barrier temperature at a frequency of one measurement per lot (defined as no more than 10,000 square feet).</p> <p>b. Lots where the temperature is greater than 27°F do not require rework; except that the lot where the</p>	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>temperature one inch beneath the surface is less than or equal to 27°F, re-work and re-test density and permeability of the affected area after the clay temperature has risen above 27°F.</p>	<p>initial temperature less than or equal to 27°F was measured shall be reworked regardless of resampling results.</p>	
<p>C. (3) If more than 30 days have passed since the date of lift approval, perform spring start-up testing.</p>		
<p>In addition, the final lift of 5×10^{-8} cm/sec radon barrier requires that the Type B filter zone and sacrificial soil next design layer be placed over the radon barrier prior to the end of the work day when ambient temperatures will drop below 32 degrees Fahrenheit. If this protective cover is not applied prior to freezing conditions, an additional density test and permeability test and permeability test shall be performed directly prior to covering the radon barrier final surface with filter zone and sacrificial soil the next design layer. This process must be repeated whenever any final surface material is not covered with the filter zone and sacrificial soil next design layer prior to overnight freezing conditions.</p>	<p>Perform an additional density test and permeability test and permeability test on 5×10^{-8} cm/sec final surface that has been exposed to overnight freezing conditions prior to placement of the Type B filter zone and sacrificial soil material next design layer. If passing test results are achieved, but it is not possible to cover all of the exposed radon barrier material with filter zone and sacrificial soil the next design layer prior to the end of the workday, testing must be repeated for the exposed materials. This testing may be performed outside of the approved lift area so long as the area tested is representative of the clay in the approved lift area (i.e., was constructed at the same time and with the same method).</p>	<p>Verify that radon barrier is tested <u>(and the testing documented)</u> during cold weather conditions.</p>
<p>157) SPRING START-UP: See “Cold Weather Placement of Radon Barrier” above <u>Specification 156</u> for situations that trigger this specification.</p> <p>For spring start-up testing, the surface lift is treated as protective cover, regardless of whether it was an approved lift of radon barrier at one time or not. Excavate nine 9 inches below the clay surface</p>	<p>Perform density and permeability and permeability testing at the frequencies outlined for radon barrier construction above. This testing may be performed outside of the approved lift area so long as the area tested is representative of the clay in the approved lift</p>	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
and re-test for density and permeability and permeability . Excavation for testing purposes may consist of removing the protective cover lift; or may be performed by ‘potholing’ only at the testing locations. Areas that have been ‘potholed’ for permeability testing for permeability testing shall be repaired by applying the same level of effort as prescribed by the approved test pad for radon barrier construction.	<p>area (i.e., was constructed at the same time and with the same method). Moisture testing is not required for spring start-up.</p> <p>a. Approve lots that meet specification. The protective cover lift may be worked in place and tested to become the next lift of radon barrier.</p> <p>b. For lots that do not meet specification, test the surface at successively deeper 9 <u>nine</u> inch increments until a passing lift is found; remove all failing lots <u>lifts</u>; re-work all failing lots <u>areas</u>; and re-test.</p> <p>Document that repairs are completed to the same level of effort as required by the approved test pad for radon barrier construction.</p>	
158) CONTAMINATION OF RADON BARRIER: The radon barrier material shall not become contaminated with radioactive soils or debris during construction. The in-place clay may contain up to five <u>5</u> percent additional rocks (less than or equal to one inch) and sand above the content found in the classification test.	Visually check radon barrier for contamination by foreign materials <u>in accordance with ASTM D2488</u> . Remove <u>or rework</u> clays which have been contaminated above the specified requirements. <u>Document corrective actions (where required) on the Daily Construction Report.</u>	<u>Verify that the radon barrier is being inspected for contaminants and that the inspection and corrective actions (if required) are properly documented.</u> Verify that removal of contaminated material has been properly documented.
159) FINAL GRADING: Final grading shall be <u>from design elevation to 0.2 feet above design elevation.</u> FINAL GRADING: Final grading shall be from grade to 0.2 feet above grade. Survey on a 50 ft grid and key points. Upon completion, the surface shall be rolled with a smooth drum roller.	Survey the <u>final grade surface of the radon barrier</u> foundation on a 50 foot <u>ft</u> grid and at key points (<u>i.e., embankment break lines</u>). Final survey measurements will be documented and provided to the QC officer <u>Lead, QC Embankment Construction and Construction QA Officer</u> <u>Quality Assurance.</u> a. Indicate where the radon barrier meets design line and grade. b. Rework and resurvey areas not meeting the specified grade.	Review the final survey data. Verify the frequency of the survey points.
160) EROSION CONTROL FOR EXPOSED SOIL: If DRCD <u>WMRC</u> -approved final		

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>elevationgrade 5 x 10⁻⁸ cm/sec radon barrier soil surfaces are not covered by filter zone the next design layer within 30 days of lift approval, the following erosion control repair measures shall apply.</p> <p>Semi-annuallyMonthly, inspect exposed radon barrier soil surfaces for evidence of erosion. Rivulet or gullied areas wider than six6 inches or deeper than 6-six inches require maintenance to fill the rivulet or gully and restore the area to design elevationgrade. Soils imported as fill shall meet the requirements of “Radon Barrier Borrow Material”, aboveSpecification 1346. Maintenance shall be performed within 30 calendar days when needed.</p> <p>Erosion control blankets, mats, or fiber mulch may be used, in accordance with the manufacturer’s instructions, for erosion prevention.</p> <p>DRCDWMRC shall be notified at least 48 hours prior to deployment of erosion control blankets, mats, or fiber mulch. If used, such erosion control materials shall be removed prior to filter zone construction.</p>	<p>Perform monthly inspections. Document the inspection as well as associated maintenance activities on the Daily Construction Report.</p> <p><u>Obtain documentation of DRCDWMRC notification.</u></p>	<p><u>Review documentation to verify that monthlysemi-annualmonthly inspections have been performed.</u></p> <p><u>Notify DRCDWMRC at least 48 hours prior to deployment of erosion control blankets, mats, or fiber mulch. Provide QC with documentation of DRCDWMRC notification.</u></p>
<p>161) RADIOLOGICAL SAMPLING FOR EXPOSED SOIL: If DRCDWMRC-approved final elevationgrade 5 x 10⁻⁸ cm/sec radon barrier soil surfaces are not covered byfilter zone the next design layer within 30 days of final approval, the area shall be either:</p> <p>(a)A. sampled and radiologically released in accordance with the Environmental Monitoring Plan; or</p>	<p>Coordinate sampling and analysis with environmental personnel. Attach a copy of the release report to the lift approval documentation.</p>	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>(b)B. have a minimum of six6 inches of clay removed and replaced prior to filter zone placement <u>of the next design layer</u>. Under <u>this</u> option —(b), no environmental sampling is required.</p>		
<p><u>162) HEAVY EQUIPMENT ON RADON BARRIER:</u> Heavy equipment travel will be minimized on top of the finished radon barrier. Heavy equipment will not be operated on saturated radon barrier.</p>	<p><u>Observe work on radon barrier. Notify the Project Manager of problems with equipment on the radon barrier. Re-inspect radon barrier and record corrective actions taken (where required) on the Daily Construction Report.</u></p>	<p><u>Verify that the work is being inspected.</u></p>
<p>HEAVY EQUIPMENT ON RADON BARRIER: Heavy equipment travel will be minimized on top of the finished radon barrier. Heavy equipment will not be operated on saturated radon barrier.</p>	<p>Observe work on radon barrier. Advise the project manager of problems with equipment on the radon barrier. Record corrective actions taken (where required) on the "Daily Construction Report".</p>	<p>Verify that the work is being inspected.</p>
<p>QUALITY ASSURANCE SAMPLING: Assurance samples for radon barrier materials tests are to be obtained at the following minimum frequency:</p> <ol style="list-style-type: none"> 1. In place moisture density tests (ASTM D6938): 1 per 50,000 cubic yards. 2. Moisture/density relationship testing (ASTM D698): 1 per 50,000 cubic yards. 3. Classification tests (ASTM D2487, D1140, and D4318): 1 per 50,000 cubic yards. <p>A minimum of one of each of the above tests is required for each year that radon barrier is placed.</p>	<p>Coordinate with QA personnel in obtaining the quality assurance samples. Record the samples on the "Sample Log" and moisture density test on the "Density Testing Log". Promptly report result of QC testing to Construction QA Officer so that a comparison of QA and QC testing results can be made.</p>	<p>Conduct or coordinate quality assurance sampling and testing in accordance with the designated frequencies. Obtain test results of QC samples so that a comparison of QA and QC test results can be made. The Construction QA Officer, in consultation with the QC officer, shall be responsible for determining the adequacy of correlation and documentation of the rationale used to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The construction QA Officer, in consultation with the QC officer, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of quality assurance sampling in the "Daily QA Report".</p>
<p><u>163) DRCDWMRC APPROVAL:</u> The DRCDWMRC shall approve documentation</p>	<p>Notify Construction QA Officer<u>Quality Assurance</u> that the radon barrier is ready for inspection by the</p>	<p>Provide written approval of the radon barrier. Notify <u>the DRCDWMRC</u> that the radon barrier is ready for</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - RADON BARRIER PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>associated with completed radon barrier. Documentation shall include all QC and QA records associated with construction, as well as photographs of the completed surface. In addition, 48 hour notification shall be provided to the DRCDWMRC prior to placement of <u>the next design layer-filter zone material</u> over the finished radon barrier. EnergySolutions may proceed with <u>filter zone</u> placement of the next design layer 48 hours after DRCDWMRC notification if the DRCDWMRC has not inspected and has not notified the Director of Engineering <u>Manager, Engineering and Maintenance</u> <u>Engineering Manager</u> of its intent to inspect the radon barrier surface.</p>	<p>DRCDWMRC. Obtain written authorization on the "Liner Inspection Form" from the Construction QA Officer <u>Quality Assurance</u> that the radon barrier has been inspected. Obtain documentation <u>of</u> DRCDWMRC <u>notification.</u> <u>Ce</u>confirming the DRCDWMRC approval of the radon barrier documentation.</p>	<p>inspection. <u>Provide QC with documentation of</u> DRCDWMRC <u>notification.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - FILTER ZONE

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>164) SCOPE: This work element applies to the Class A West and 11e.(2) embankments.</p> <p>QUALITY OF ROCK: The rock shall have a "Rock Quality" score of at least 50 based on the following tests: Specific Gravity (ASTM C 128), Absorption (ASTM C 127), Sodium Soundness (ASTM C 88), and L.A. Abrasion (ASTM C 131 or ASTM C 535). The procedures for scoring "Rock Quality" are found in Appendix C.</p>	<p>As described in NUREG 1623, appendix F, perform at least one petrographic examination for each rock source in accordance with ASTM C 295. If a combination of limestone, sandstone, and igneous rock is found for a source, percentages of each type of material shall be determined for scoring.</p> <p>Perform Na soundness, LA abrasion, absorption, and specific gravity testing at a rate of one set of tests per 10,000 cubic yards of rock. Record the location of all collected samples in the "Sampling Log".</p> <p>a. Approve rock for use in the filter zone which meet the specifications for rock quality.</p> <p>b. Rock not meeting the specifications for rock quality can not be used.</p>	<p>Verify the frequency of laboratory quality control tests and compliance of test results.</p> <p>Perform quality assurance testing at a minimum of one set of tests per 100,000 cubic yards of rock. A minimum of one set of tests is required each year that filter zone is placed. Record the samples on the "Sampling Log". Promptly report results to the Construction QA Officer so that a comparison of QA and QC testing results can be made. The Construction QA Officer, in consultation with the QC officer, shall be responsible for determining the adequacy of correlation and documentation of the rationale used to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The Construction QA Officer, in consultation with the QC officer, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of the quality assurance sampling in the "Daily QA Report".</p>
<p>165) TYPE B FILTER ZONE PERMEABILITY: The type B filter zone rock on the Class A West and Class A North embankments will have a minimum permeability of 3.5 cm-per second/sec.</p> <p>The filter zone rock on the 11e.(2) embankment will have a minimum hydraulic conductivity of 42 cm/sec.</p>	<p>Perform permeability testing at a rate of one test per 10,000 cubic yards placed. Record the location of all samples in the "Sampling Log".</p> <p>a. Approve rock for use in the filter zone which meets the specified gradation.</p> <p>b. Rock not meeting the specified gradation cannot be used.</p>	<p>Verify the frequency of laboratory tests and compliance of test results.</p>
<p>166) GRADATION: LLRW embankment rock gradation shall be as specified on the currently</p>	<p>For Type B filter zone rock, if material is to be stockpiled, perform gradation testing at a rate of one</p>	<p>Verify the frequency of laboratory quality control tests and compliance of test results.Perform quality</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - FILTER ZONE

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>approved engineering drawings 10014. Class A West and 11e.(2) embankment rock gradation shall be as specified on the currently approved engineering drawings <u>listed in Groundwater Quality Discharge Permit UGW450005-9420-4.</u></p>	<p>test per 2,500<u>10,000</u> cubic yards stockpiled. If Type B filter zone rock material is transferred directly to the cell from the production plant, perform at least one <u>gradation</u> test (ASTM C 136) per source per day material is placed, or at least one test per 2,500<u>10,000</u> cubic yards. For Type A filter zone rock, perform gradation testing at a rate of one test per 10,000 cubic yards. <u>For all of these, a minimum of four tests is necessary per embankment.</u></p> <p>In addition, perform a minimum of one test per change in soil type by ASTM D2488. Record the location of all samples in the "Sampling Log".</p> <p><u>If any deficiencies are identified in gradation testing, notify the Project Manager to have operations rework the material. After reworking (if necessary), retest the material and record corrective actions (where required) in the Daily Construction Report.</u></p> <p>a. Approve rock for use in the filter zone which meet the specified gradation. b. Rock not meeting the specified gradation can not be used.</p>	<p>assurance testing at a minimum of one set of tests per 100,000 cubic yards of rock. A minimum of one set of tests is required each year that filter zone is placed. Record the samples on the "Sampling Log". Promptly report results to the Construction QA Officer so that a comparison of QA and QC testing results can be made. The Construction QA Officer, in consultation with the QC officer shall be responsible for determining the adequacy of correlation and documentation of the rationale used to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The Construction QA Officer, in consultation with the QC officer, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of the quality assurance sampling in the "Daily QA Report".</p>
<p>167) PLACEMENT: Filter zone material will be placed over the radon barrier. The thickness of the filter zone layer for the LLRW embankments shall be as specified on the currently approved engineering drawings 10014. The thickness of the filter zone layer for the <u>Class A West and</u> 11e.(2) embankments shall be as specified on the currently approved engineering drawings <u>listed in Groundwater Quality Discharge Permit UGW450005-9420-4, 9420-5, and 9420-6.</u> Filter zone material shall be handled in such a manner as to prevent contamination from waste material and segregation of finer materials.</p>	<p>Observe the placement of the filter zone material. Ensure that <u>the filter zone is uniform in appearance with no</u> soil fines or rock are not concentrated in localized areas. If soil fines are concentrated in localized areas, the filter zone is not uniform in appearance, <u>advise</u> notify the Project Manager shall be directed to have operations evenly distribute the fines or to remove them filter zone material. <u>Re-inspect the filter zone material and</u> Record-record corrective actions (where required) in the "Daily Construction Report" <u>Daily Construction Report</u>.</p>	<p><u>Review documentation and v</u> Verify that QC personnel observe the placement of the filter zone material such that <u>it is uniform in appearance</u>, soil fines are not concentrated in localized areas.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - FILTER ZONE

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>168) SNOW REMOVAL: When filter zone material is to be placed and the work area is covered with snow, the snow must be removed.</p>	<p>Observe that snow is removed. <u>Inspect the filter zone for damage. Advise-Notify</u> the Project Manager of any deficiencies/damage. Construction may not continue without taking corrective actions to remove the snow. Re-inspect the filter zone and Record-record corrective actions (where required) in the "Daily Construction Report"<u>Daily Construction Report</u>.</p>	<p>Verify that snow removal is being documented <u>and the filter zone has been inspected</u>.</p>
<p>169) FINAL GRADING: Thickness for the lift will be established by installing grade poles on at least a 50' grid and at all control points. The grade poles shall consist of PVC pipe (approximately ½-inch diameter) with surveyor's ribbon (or other distinguishable markings) attached to the appropriate lift thickness. The poles shall be held in place by placing the filter rock adjacent to the base of the grade pole to secure it in a vertical position (long axis of the grade pole perpendicular to the radon barrier surface). With the grade pole marked at the appropriate thickness and secured at the appropriate locations, the filter rock may be placed throughout the project area. The base of the grade poles shall rest on the surface of the radon barrier and therefore will not damage the radon barrier surface. After the grade has been checked and approved by QC personnel, the grade poles shall be removed from the filter zone—placed directly above the radon barrier.</p>	<p>Verify that the grade poles are marked at the appropriate depth to establish grade for the layer that will be placed. Observe the installation of some of the grade poles to ensure that the installation method has been followed and verify that the grade poles have not penetrated or damaged the surface of the radon barrier.</p> <p>Verify the required grade is achieved at all control points throughout the placed filter rock in the project area. <u>Confirm that the in-place thickness of the rip rap material is between 90 percent and 125 percent of the design thickness.</u> Rework and re-verify areas not meeting the specified grade. Ensure all grade poles have been removed following verification of grade. Document all inspections and corrective actions, where required, on the "Daily Construction Report"<u>Daily Construction Report</u>.</p>	<p>Review documentation for final grading.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - SACRIFICIAL SOIL PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
170) SCOPE: This work element applies to the Class A West embankment.		
171) PLACEMENT: Sacrificial soil will be placed over the filter zone as specified on currently approved engineering drawings 40014 listed in Groundwater Quality Discharge Permit UGW450005 . Sacrificial soil shall be handled in such a manner as to prevent contamination from waste material and segregation of finer materials.	Observe the placement of the sacrificial soil. Ensure that fines are not concentrated in localized areas. If fines are concentrated in localized areas, the Project Manager shall be directed to evenly distribute the fines or to remove them. Record corrective actions (where required) in the "Daily Construction Report".	Verify that QC personnel observe the placement of the sacrificial soil such that fines are not concentrated in localized areas.
172) GRADATION: Gradation of the sacrificial soil shall be as specified on the currently approved engineering drawings listed in Groundwater Quality Discharge Permit UGW450005 40014 . Gradation shall be determined prior to placement of the sacrificial soil.	If material is to be stockpiled, perform gradation testing at a rate of one test per 2,500 cubic yard stockpile. If material is transferred directly to the cell from the production plant, perform at least one test per source per day material is placed, or at least one test per 2,500 cubic yards. In addition, perform a minimum of one test per change in soil type by ASTM D 2488. Record the location of all samples in the "Sampling Log". a. Approve material for use as sacrificial soil which meets the specified gradation. b. Material not meeting the specified gradation can not be used.	Verify the frequency of laboratory tests and compliance of test results.
173) SNOW REMOVAL: When sacrificial soil is to be placed and the work area is covered with snow, the snow must be removed.	Observe that snow is removed. Advise Notify the Project Manager of any deficiencies. Construction may not continue without taking corrective action to remove the snow. Re-inspect and Record record corrective actions (where required) in the "Daily Construction Report".	Verify that snow removal is being documented as per DWMRC requirement.
174) FINAL GRADING: Thicknesses for the lift will be established by installing grade poles on at least a 50' foot grid and at all control points. The grade poles must be marked at the appropriate depth to establish grade. After the grade has been	Verify the required grade is achieved at all control points. Confirm that the in-place thickness of the sacrificial soil is between 90 percent and 125 percent of the design thickness. Notify the Project Manager of areas not meeting the specified grade. Re-verify after	Review the documentation for final grading.

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - SACRIFICIAL SOIL PLACEMENT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
checked and approved by QC personnel, the grade poles shall be removed.	Rework <u>rework has been completed. Document all inspections and corrective actions, where required, on the Daily Construction Report, and re-verify areas not meeting the specified grade.</u>	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - ROCK EROSION BARRIER

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>175) SCOPE: This work element applies to the Class A West and 11e.(2) embankments and Class A West ditches.</p> <p>QUALITY OF ROCK: The rock shall have a "Rock Quality" score of at least 50 based on the following tests: Specific Gravity (ASTM C 128), Absorption (ASTM C 127), Sodium Soundness (ASTM C 88), and L.A. Abrasion (ASTM C 131 or ASTM C 535). The procedures for scoring "Rock Quality" are found in Appendix C.</p>	<p>As described in NUREG 1623, appendix F, perform at least one petrographic examination for each rock source in accordance with ASTM C 295. If a combination of limestone, sandstone, and igneous rock is found for a source, percentages of each type of material shall be determined for scoring.</p> <p>Record the location of all collected samples in the "Sampling Log". Test rock at a rate of one set of test for every 10,000 cubic yards of rock.</p> <p>a. Approve rock for use in the rock erosion barrier which meet the specifications for rock quality.</p> <p>b. Rock not meeting the specifications for rock quality can not be used.</p>	<p>Verify the frequency of laboratory quality control tests and compliance of test results.</p> <p>Perform quality assurance testing at a minimum of one set of tests per 100,000 cubic yards of rock. A minimum of one set of tests is required each year that filter zone is placed. Record the samples on the "Sampling Log". Promptly report results to the Construction QA Officer so that a comparison of QA and QC testing results can be made. The Construction QA Officer, in consultation with the QC officer, shall be responsible for determining the adequacy of correlation and documentation of the rationale used to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The Construction QA Officer, in consultation with the QC officer, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of the quality assurance sampling in the "Daily QA Report".</p>
<p>176) GRADATION: Gradation of the rock for the LLRW embankments shall be as specified on the currently approved engineering drawings 10014. Gradation of the rock (top slope and side slope) for the 11e.(2) embankment shall be as specified on the currently approved engineering drawings listed in Groundwater Quality Discharge Permit UGW450005-UGW450005.9420-4</p>	<p>Perform gradation testing, in accordance with ASTM D5519 or C136, at a rate of one test per 10,000 cubic yards <u>with a minimum of four tests per embankment</u>. Record the location of all samples in the "Sampling Log".</p> <p><u>If any deficiencies are identified in gradation testing, notify the Project Manager to have operations rework the material. After reworking (if necessary), retest the material and record corrective actions (where required) in the Daily Construction Report.</u></p>	<p>Verify the frequency of laboratory quality control tests and compliance of test results. <u>Perform quality assurance testing at a minimum of one set of tests per 100,000 cubic yards of rock. A minimum of one set of tests is required each year that filter zone is placed. Record the samples on the "Sampling Log". Promptly report results to the Construction QA Officer so that a comparison of QA and QC testing results can be made. The Construction QA Officer, in consultation with the QC, shall be responsible for determining the adequacy of correlation and documentation of the rationale used</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - ROCK EROSION BARRIER

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
	<p>a. Approve rock for use in the rock erosion barrier which meet the specified gradation.</p> <p>b. Rock not meeting the specified gradation can not be used.</p>	<p>to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The Construction QA Officer, in consultation with the QC officer, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of the quality assurance sampling in the "Daily QA Report".</p>
<p>177) PLACEMENT: Rock erosion material will be placed over the filter zone. Thickness of rock erosion barrier shall be 18 inches inside the centerline of the perimeter ditch and 12 inches outside the centerline of the perimeter ditch <u>as described in the currently approved engineering drawings listed in Groundwater Quality Discharge Permit UGW450005</u>. Rock erosion material shall be handled in such a manner as to prevent contamination from waste material and segregation of finer materials.</p>	<p>Observe the placement of the rock. Ensure that soil fines are not concentrated in localized areas. If soil fines are concentrated in localized areas, <u>advise-notify</u> the Project Manager shall be directed to <u>have operations</u> evenly distribute the fines or to remove them. <u>Re-inspect after the Project Manager makes changes</u>. Record corrective actions (where required) in the "Daily Construction Report".</p>	<p>Verify that QC personnel observe the placement of the filter zone material such that soil fines are not concentrated in localized areas.</p>
<p>178) SNOW REMOVAL: When rock erosion barrier material is to be placed and the work area is covered with snow, the snow must be removed.</p>	<p>Observe that snow is removed. <u>Inspect the rock erosion barrier for damage. Advise-Notify</u> the Project Manager of any deficiencies. Construction may not continue without taking corrective action to remove the snow. Re-inspect and Record-record corrective actions (where required) in the "Daily Construction Report" <u>Daily Construction Report</u>.</p>	<p>Verify that snow removal is being documented as per DRCDWMRC requirement and the rock erosion barrier has been inspected.</p>
<p>179) FINAL GRADING: Thickness for the lift will be established by installing grade poles on at least a 50-70 foot² grid and at all control points <u>or by GPS survey</u>. The grade poles shall consist of PVC pipe (approximately 1/2¹ <u>one-half</u> inch diameter) with surveyor ribbon (or other distinguishable markings). The grade poles must</p>	<p>Verify the required grade is achieved at all control points. <u>Confirm that the in-place thickness of the sacrificial soil is between 90 percent and 125 percent of the design thickness. Notify the Project Manager of areas not meeting the specified grade. Re-verify after Rework-rework has been completed and re-verify areas not meeting the specified grade.</u> Document all</p>	<p>Review the documentation for final grading.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - ROCK EROSION BARRIER

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
be marked at the appropriate depth to establish grade. After the grade has been checked and approved by QC personnel, the grade poles shall be removed.	inspections and corrective actions; (where required, on the "Daily Construction Report" <u>Daily Construction Report</u>).	
180) NOTICE OF COVER CONSTRUCTION: Provide written notice of the completion of cover construction to the <u>DRC DWMRC</u> within 30 days of completion of each phase of cover construction in the "cut and cover" operation.	Verify the DRC has been notified of completion of cover construction within 30 days of completion of each phase of cover construction. <u>Obtain documentation of DRC DWMRC notification.</u>	<u>Within 30 days of completion of each phase of cover construction, notify the DRC DWMRC has been notified of completion of cover construction, within 30 days of completion of each phase of cover construction. Provide QC with documentation of DRC DWMRC notification. Note: The Engineering Manager, or designee, may notify the DRC DWMRC and provide Quality Assurance documentation of the notification.</u>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – DRAINAGE DITCH IMPORTED BORROW

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
181) SCOPE: This work element applies to the Class A West and 11e.(2) embankments.		
182) CLEARING AND GRUBBING: Remove vegetation, debris, organic, or deleterious material from areas to be used for borrow. Grubbing depth will depend on the type of vegetation, debris, organic, or deleterious material on the site. If the area is free of these materials then no clearing and grubbing will be necessary.	Inspect the area once clearing and grubbing has been completed. Record observations and corrective actions (where required) on the "Daily Construction Report".	Verify that the clearing and grubbing has been inspected by QC.
183) MATERIAL: The imported borrow shall be classified as CL or ML soils by ASTM D-2487.	Perform laboratory classification tests at a rate of <u>one</u> test per lot prior to use of material in the road. A lot is defined as a maximum of 3,000 cubic yards (compacted) of specified material type. Record the location of the classification sample on the "Sampling Log". a. Approve lots (which meet the specified classification) for use in the road. b. Lots not meeting the specified classification cannot be used.	Verify the frequency of laboratory tests and compliance of test results.
184) LIFT THICKNESS: Drainage ditch borrow material shall be placed in lifts with an uncompacted thickness of less than or equal to <u>9</u> inches. <u>A.</u> Thickness for the lift will be established by installing grade poles on at least a 50-foot grid lengthwise and at all control points. The grade poles must not be installed deeper than 1 inch into the underlying clay liner. The grade poles must be marked at the appropriate depth to establish the grade. After the grade has been checked and approved by QC personnel, the grade poles shall be removed.	Verify that the required grading is achieved as follows: a. Ensure that the required frequency for placement of grade poles has been met. b. Compare soil level with the marked level on the grade poles. c. Use a string line where necessary Visually check between poles to check for high or low spots. d. Define those areas that are high out of specification and advise the Project Manager to re-work those areas. e. Review areas re-worked and approve areas meeting criteria. f. Continue " <u>b</u> " through " <u>d</u> " above until all areas meet criteria. g. Indicate areas meeting criteria in the "Embankment	<u>Verify the frequency of measurements and compliance of test results.</u> Observe, at a minimum, five percent of the measurements performed by QC personnel to ensure that the measurements are being performed correctly. Verify that the measurements are being performed at the correct frequency and that the documentation is being completed.

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – DRAINAGE DITCH IMPORTED BORROW

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
	Construction Lift Approval Form”.	
<u>- OR -</u>	<u>- OR -</u>	
<u>B. Survey to determine lift thickness. Survey equipment shall have a tolerance no more than ± 0.1 foot.</u>	<u>a. Verify survey equipment is within a tolerance of ± 0.1 foot.</u> <u>b. Verify correct set-up and operation of equipment.</u> <u>c. Visually check between survey points for high or low spots.</u> <u>d. Define high out of specification areas and notify the Project Manager to rework those areas.</u> <u>e. Document survey results on a survey report.</u>	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - DRAINAGE DITCHES

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>185) SCOPE: This work element applies to the Class A West and 11e.(2) embankments.</p>		
<p>186) EXCAVATION: Excavation shall be made to the lines, grades, and dimensions prescribed in the <u>approved phase-specific approved plans</u>. <u>Temporary (operational) ditches may be constructed to these phase-specific plans. Final design grade and dimensions (as shown in the approved engineering drawings listed in Groundwater Quality Discharge Permit UGW450005) are not required to be met before final closure of the Class A West or 11e.(2) embankments.</u></p> <p>Prior DREDWMRC approval in writing must be obtained before diverting ditches from the current approved design. The purpose and duration of diversion shall be specified in any request to do so.</p>	<p>Provide daily observation of the cell excavation. Record observations and corrective actions (where required) on the "Daily Construction Report"<u>"Daily Construction Report"</u>.</p> <p><u>If necessary, notify DREDWMRC of ditches that need to be diverted.</u></p>	<p><u>Verify daily observations and corrective actions have been documented. Verify the frequency of laboratory tests and compliance of test results.</u>Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.</p>
<p>Any over excavation shall be backfilled with select materials and compacted to 95 percent of standard Proctor. The uncompacted lift thickness shall not exceed <u>nine</u>9 inches.</p>	<p>In areas of over excavation, conduct in-place density test at a rate of one test per lot and record the results on the Field Density Test form. A lot is defined as a maximum of 10,000 square feet of a lift of a specified type of material. Test locations shall be chosen on the basis of random numbers <u>(described in Specification 12)</u>.</p> <ol style="list-style-type: none"> Approve lots which meet the specified compaction. Rework and retest lots not meeting the specified compaction. <p>Proctors shall be performed at a rate of one test per 100,000 square feet for each material type. At least one proctor shall be performed for each material type. Record the location of the sample on the "Sampling Log".</p>	<p><u>Verify that DREDWMRC approvals have been obtained before diverting ditches</u></p> <p><u>Verify the frequency of laboratory tests and compliance of test results.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - DRAINAGE DITCHES

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>187) FINAL GRADING: Smooth roll the excavated surface to prepare for filter zone <u>or riprap</u>. Final grading of this surface shall be ± 0.1 of a foot.</p>	<p>Inspect the surface for smoothness. Survey the surface on a 50 foot^{ft} grid and at key points (<u>i.e., changes in direction of the ditch</u>). Final survey measurements will be documented <u>on the survey report</u> and provided to the QC officer^{Lead, QC Embankment Construction and Construction QA Officer}<u>Quality Assurance</u>.</p> <p>a. Indicate where the surface meets design line and grade.</p> <p>b. Rework and resurvey areas not meeting the specified grade.</p>	<p>Review the final survey data. Verify the frequency of the survey points.</p>
<p>188) FILTER ZONE AND ROCK EROSION BARRIER: As described in approved engineering drawings listed in Groundwater Quality Discharge Permit UGW450005., 11e.(2) ditches consist of a filter zone below a riprap layer while the ET cover ditches consist only of a riprap layer. The filter zone and rock erosion barrier <u>layers</u> shall be constructed in accordance with <u>Specifications 1644 thru 17180 as appropriate.</u></p> <p>the specifications outlined under work elements "Filter Zone" and "Rock Erosion Barrier" respectively.</p>	<p>See <u>Specifications 1644 thru 17180</u> work elements <u>"Filter Zone" and "Rock Erosion Barrier"</u>.</p>	<p>See <u>Specifications 1644 thru 17180</u> work elements <u>"Filter Zone" and "Rock Erosion Barrier"</u>.</p>
<p>189) EROSION CONTROL FOR EXPOSED SOIL: If reviewed and approved drainage ditch soil surfaces are not covered by filter zone <u>or riprap</u> within 30 days of lift approval, the following erosion control repair measures shall apply.</p> <p>Semi annually^{Monthly}, inspect exposed drainage ditch soil surfaces for evidence of erosion. Rivulet or gullied areas wider than 6-six^{six} inches or deeper than six6^{six} inches require maintenance to fill the rivulet or gully and restore the area to design <u>elevation grade</u>. Soils imported as fill shall meet</p>	<p>Perform semi annual^{monthly}monthly inspections. Document the inspection as well as associated maintenance activities on the Daily Construction Report.</p>	<p><u>Review documentation to verify that monthly inspections have been performed.</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - DRAINAGE DITCHES

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>the requirements of “Drainage Ditch Imported Borrow”, above. Maintenance shall be performed within 30 calendar days when needed, unless additional time is approved by DRCDWMRC.</p> <p>Erosion control blankets, mats, or fiber mulch may be used, in accordance with the manufacturer’s instructions, for erosion prevention.</p> <p>DRCDWMRC shall be notified at least 48 hours prior to deployment of erosion control blankets, mats, or fiber mulch. If used, such erosion control materials shall be removed prior to filter zone or riprap construction.</p>	<p><u>Obtain documentation of DRCDWMRC notification</u></p>	<p><u>Notify DRCDWMRC at least 48 hours prior to deployment of erosion control blankets, mats, or fiber mulch. Provide QC with documentation of DRCDWMRC notification.</u></p>
<p>190) RADIOLOGICAL SAMPLING FOR EXPOSED SOIL: If reviewed and approved drainage ditch soil surfaces are not covered by filter zone or riprap within 30 days of lift approval, the area shall either</p> <p>A. (a) be sampled and radiologically released in accordance with the Environmental Monitoring Plan; or</p> <p>B. (b) have a minimum of six6 inches of clay <u>ditch material</u> removed and replaced prior to filter zone or riprap placement. Under option(b), no environmental sampling is required.</p>	<p>Coordinate sampling and analysis with environmental personnel. Attach a copy of the release report to the lift approval documentation.</p>	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - INSPECTION ROAD

SPECIFICATION

QUALITY CONTROL

QUALITY ASSURANCE

191) SCOPE: This work element applies to the Class A West and 11e.(2) embankments.

192) MATERIAL: The material used to construct the road shall conform to the following specification:

<u>Sieve Size</u>	<u>Percent% Passing</u>
1-1/2 inch "	100
3/4 3/4 inch "	75-95
1/2 1/2 inch "	62-82
# 4	38-58
# 16	16-36
# 200	0-18

193) SUBSURFACE PREPARATION: The subsurface will be scarified and re-compacted to at least 95 percent of a standard proctor (ASTM D698).

Perform laboratory classification tests at a rate of ~~one~~ test per lot prior to use of material in the road. A lot is defined as a maximum of 3,000 cubic yards (compacted) of specified material type. Record the location of the classification sample on the "Sampling Log".

a. Approve lots which meet the specified classification.

b. Notify the Project Manager of lots not meeting the specified classification to have the areas reworked.

c. Retest lots after rework has been completed.

~~a. Approve lots (which meet the specified classification) for use in the road.~~

~~b. Lots not meeting the specified classification can not be used.~~

Conduct in-place density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 200 cubic yards (compacted) of material. The test location shall be chosen on the basis of random numbers (described in Specification 12).

a. Approve lots which meet the specified compaction.

b. Notify the Project Manager of lots not meeting the specified compaction to have the areas reworked.

c. Retest lots after rework has been completed.

~~a. Approve lots which meet the specified compaction.~~

~~b. Rework and retest lots not meeting the specified compaction.~~

Proctors shall be performed at a rate of one test per borrow lot. A borrow lot is defined as 3,000 cubic yards (compacted) or less of a specific material type. Record the location of the Proctor sample on the "Sampling Log".

Verify the frequency of laboratory tests and compliance of test results.

Verify the frequency of tests and compliance of test results. ~~Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.~~

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - INSPECTION ROAD

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>194) ROAD THICKNESS: The compacted road shall be 12 inches thick plus or minus 0.2 feet.</p>	<p>Measure the thickness of the road at both edges of the road at no greater than 50 foot intervals. Record the results on the "Lift Approval Form".</p> <p><u>a. Approve lots which meet the specified thickness.</u> <u>b. Notify the Project Manager of lots not meeting the specified thickness to have the areas reworked.</u> <u>c. Retest lots after rework has been completed.</u> a. Approve section of the road which meet the specified thickness. b. Rework and retest sections not meeting the required thickness.</p>	<p><u>Verify the frequency of tests and compliance of test results.</u>Observe, at a minimum, five percent of the measurements performed by the QC personnel to ensure that the measurements are being performed correctly. Verify that the measurements are being performed at the correct frequency and that the documentation is being completed.</p>
<p>195) COMPACTION: The road will be compacted to at least 95 percent of standard Proctor (ASTM D698).</p>	<p>Conduct in-place density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 200 cubic yards (compacted) of material. The test location shall be chosen on the basis of random numbers <u>(described in Specification 12)</u>.</p> <p><u>a. Approve lots which meet the specified compaction.</u> <u>b. Notify the Project Manager of lots not meeting the specified compaction to have the areas reworked.</u> <u>c. Retest lots after rework has been completed.</u> a. Approve lots which meet the specified compaction. b. Rework and retest lots not meeting the specified compaction.</p> <p>Proctors shall be performed at a rate of one test per borrow lot. A borrow lot is defined as 3,000 cubic yards (compacted) or less of a specific material type. Record the location of the Proctor sample on the "Sampling Log".</p>	<p><u>Verify the frequency of tests and compliance of test results.</u>Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - PERMANENT CHAIN LINK FENCES

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>196) SCOPE: This work element applies to the Class A West and 11e.(2) embankments.</p>		
<p>197) MATERIALS: All burial embankments and waste storage areas, including immediately adjacent drainage structures, shall be controlled areas, surrounded by six-foot high, chain link fence. All permanent fences shall be chain link, six feet high, topped with three strand barbed wire, top tension wire and twisted selvedge.</p> <p>Zinc coated chain link fence shall meet the requirements of ASTM A392 with Class I coating. Aluminum Coated fence fabric shall meet the requirements of ASTM A491.</p> <p><u>Fence Fabric:</u> Fence fabric shall be made of 0.148 inch or larger diameter wire. The fabric shall have twisted selvedge.</p> <p><u>Wire and Ties:</u> Tension wires shall be 0.177 inch or larger diameter spiral type. Ring ties for tying fabric to supporting members shall be made of 0.148 inch or larger diameter wire. Wire ties for tying fabric to support members shall be made of 0.12 inch or larger diameter wire. Ties to line posts shall be made of 0.192 inch or larger diameter wire. All wire shall have Class II coating as specified by ASTM A116.</p> <p><u>Barbed Wire:</u> Barbed wire on zinc coated fence shall meet the requirements of ASTM A121, including a Class I zinc coating. Barbed wire shall be made of 0.099 inch or larger diameter wire with 0.080 inch or larger diameter wire four point barbs on five inch centers. When aluminum or aluminum coated fence is used, aluminum coated</p>	<p>Obtain a copy of the manufacture's specification for the materials to be used in the construction of the fence. Verify that the materials meet the required specifications. Document materials acceptance on the "Daily Construction Report"<u>Daily Construction Report</u>.</p>	<p>Verify that the materials to be used in the construction of the fence have been approved <u>and documented</u>.</p>
<p>REVISION: 26d27aXX</p>	<p>page 129 of 138</p>	<p>Date: May 7<u>October 25, 2012</u>XXXX</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - PERMANENT CHAIN LINK FENCES

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>barbed wireware shall be used meeting the requirements of ASTM A0491. The support arm on the fence for the barbed wire shall be capable of supporting a 200 pound vertical load at the end of the arm without permanent deflection.</p> <p><u>Posts:</u> Line posts may be "H" section or pipe. The minimum strength requirements are as follows:</p> <p>A.1 Load at top: 600 lbs.</p> <p>B.2 Maximum Moment: 1200 ft-lbs.</p> <p>C.3 Maximum permanent set: 0.010 in.</p> <p>"H" posts shall be coated in accordance with the requirements of ASTM A123. Pipe posts shall conform to the requirements of ASTM A120 (Schedule 40) for zinc coated pipe. All pipe posts shall be fitted with a weather resistant tip, designed to fit securely over the post, and carry an apron around the outside of the post.</p> <p><u>Fittings:</u> Fittings shall be malleable cast iron or pressed steel and be coated in accordance to ASTM A123.</p> <p><u>Gates:</u> Gate posts and frames shall be constructed of the sizes shown on the approved plans for the various gate dimensions. The corners of the gate frame shall be fastened together with pressed steel or malleable iron corner ells riveted or welded in accordance with the plans. Welded steel gate frames shall be galvanized after fabrication in accordance with the provision of ASTM A123. Chain link fence fabric for covering the gate frames shall be the same as required for the fence.</p>		

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - PERMANENT CHAIN LINK FENCES

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
Each gate shall be furnished complete with necessary galvanized hinged, latch, and drop bar locking device for the type of gate used on the project.		
198) INSTALLATION: The steel posts shall be set true to line and grade in concrete bases. The distances between posts shall be uniform and not exceeding 10 feet. Fence corners and ends shall be constructed in accordance with Detail A on sheet L9 of the approved engineering drawings <u>listed in Groundwater Quality Discharge Permit UGW450005</u> . Gates shall be constructed in accordance with Detail B on sheet L9 of the approved engineering drawings.	Verify that the fence is constructed in the location shown on the plans and in accordance with sheet L9. Document any problems in the "Daily Construction Report" <u>Daily Construction Report</u> .	Verify that the fence has been inspected and problems have been properly documented. Verify that the fence has been inspected and problems have been properly documented. Verify that the fence has been inspected and problems have been properly documented. Verify that the fence has been inspected and problems have been properly documented.
A minimum of six 6 inches of concrete shall be provided below the bottom of each post. End posts, pull posts, corner posts, and gate posts shall have a concrete base at least 12 inches in diameter. Bases for line posts shall be at least 10 inches in diameter.	Spot check the depth and diameter of the post holes to verify that the holes meet the required specification. Document any problems in the "Daily Construction Report" <u>Daily Construction Report</u> .	
Pull posts shall be provided at 500 feet maximum intervals. Changes in line of 30 degrees or more shall be considered as corners.	Inspect the fence for proper placement of pull and corner posts. Document any problems in the "Daily Construction Report" <u>Daily Construction Report</u> .	
The fabric shall be stretched taut, and securely fastened to the posts. Fastening to end, gate, corner, and pull posts shall be with stretcher bars and metal bands, spaced at one foot intervals. The fabric shall be cut and each span fastened independently at all pull and corner posts. Fastening to line posts shall be with tie wire, metal bands, or other approved method at 14 inch intervals. The top edge of fabric shall be attached to the top rail or tension cable at approximately 24	Inspect the fencing fabric to verify that it has been installed in accordance with the specifications. Document any problems in the "Daily Construction Report" <u>Daily Construction Report</u> .	

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT - PERMANENT CHAIN LINK FENCES

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
inch intervals. The bottom edge of the fabric should be installed within one inch of the ground surface. The bottom tension wire is required and shall be attached to the fabric with tie wires at 24 inch intervals and shall be secured to the end or pull posts with brace bands.		

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – SETTLEMENT MONITORING

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>199) SCOPE: This work element applies to the LARW, Class A West, 11e.(2), and Mixed Waste embankments.</p>		
<p>200) SETTLEMENT MONUMENTS: Settlement monuments constructed before January 1, 2005 consist of #4 or greater rebar that is approximately three3 feet long, secured in place using a sand-cement grout. Grout shall consist of approximately 1/20.5 cubic foot of low slump fiber reinforced grout per monument. The top of the rebar shall be placed roughly even with the top of the riprap rock. Each monument shall be permanently labeled, flagged, and documented on a reference drawing.</p> <p>Settlement monuments constructed after January 1, 2005 shall consist of approximately four4-foot long #5 or greater rebar that is welded to a metal plate. The metal plate shall be approximately 18 inches square with a thickness of 3/16 inch to 1/4 inch. The rebar shall be sized to extend no more than six6 inches above the rock erosion barrier surface. The settlement plate shall be placed on top of the final approved radon barrier (Class A and LARW cells) or on top of the final approved geosynthetics layer (Mixed Waste) and then secured by the rock cover layers as they are built. Each monument shall be permanently labeled, flagged, and documented on a reference drawing.</p>	<p>Inspect settlement monuments for compliance with the specification prior to installation. Observe installation to ensure that the radon barrier or geosynthetic layer is not damaged.</p>	<p>Perform a surveillance of monument installation activities.</p>
<p>201) SETTLEMENT MONUMENT PLACEMENT: Settlement monuments constructed prior to January 1, 2005 are set at 100- and 200-foot grids, as indicated on Figure 1.</p> <p>Settlement monuments constructed after January 1,</p>	<p>Perform and document a post-construction survey of</p>	<p>Verify that surveys have been performed <u>and</u></p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – SETTLEMENT MONITORING

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
2005 on the LARW, Class A <u>West</u> , Mixed Waste, <u>and 11e.(2), and Class A North</u> embankments shall be placed at the locations identified on Figures 1, 2, 3, and 4, respectively.	the placed settlement monument.	<u>documented</u> .
202) SURVEY REQUIREMENTS: Surveys shall be performed with GPS or approved equivalent equipment. Tolerance shall be no more than ± 0.1 feet.	Calibrate and operate survey equipment in accordance with the manufacturer's recommendations	
203) SURVEY INTERVAL: Settlement monuments constructed before January 1, 2005 shall be surveyed prior to grouting and again afterwards within 30 days of grouting for coordinate verification. Annual surveys of the existing monuments shall continue for a minimum of <u>five</u> years from the date of grouting. In cases where monuments are reset, measurements shall continue at the specified frequency continuing from the last reliable measurement. Weather conditions at the time of the survey and a discussion of the potential for frost to be present shall be documented in the survey report.	Perform and document the required surveys <u>in a survey report</u> . Provide survey data to the Director of Engineering Manager, Engineering and Maintenance <u>Engineering Manager</u> .	Verify that monument surveys are completed <u>and documented</u> as required.
Settlement monuments constructed after January 1, 2005 shall be set and surveyed for initial location within 30 days of the completion of final cover construction. New monuments shall be surveyed again at 2, 4, and 12 months (± 10 calendar days) after the initial survey. Thereafter, monuments shall be surveyed once annually between October 1 and December 31 until a minimum of <u>five</u> years after initial placement. Weather conditions at the time of the survey and a discussion of the potential for frost to be present shall be documented in the survey report.	Perform and document the required surveys <u>in a survey report</u> . Provide survey data to the Director of Engineering Manager, Engineering and Maintenance <u>Engineering Manager</u> .	Verify that new monument surveys are completed <u>and documented</u> as required.

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – SETTLEMENT MONITORING

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p>During the annual survey, perform a visual inspection of the completed cover to evaluate potential areas of settlement that may not be captured by the settlement monument network.</p> <p>204) REPORTING: Settlement monitoring data shall be summarized and evaluated in the annual as-built report for each embankment.</p> <p>Calculate total and differential settlement for each settlement monument against the most recent measurement and against the baseline monument location.</p> <p>Total settlement of more than 1.5 feet at any settlement monument or differential settlement of more than 1.0 percent slope between adjacent monuments shall be reported to and evaluated by the <u>Engineering Manager, Engineering and Maintenance</u> Director of Engineering within 30 days of measurement and discussed in the annual as-built report.</p> <p>Any failure in the settlement monuments shall be documented. A replacement monument shall be reset as close as possible to the previous location, surveyed, and documented.</p>	<p>Document observations made during the inspection, and denote areas where differential settlement may be occurring. Provide documentation to the Director of Engineering Manager, Engineering and Maintenance <u>Engineering Manager</u>.</p> <p>Provide settlement monitoring data to the <u>Engineering Manager, Engineering and Maintenance</u> Director of Engineering.</p>	<p>Perform a surveillance of visual inspection activities.</p>

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – ANNUAL AS-BUILT REPORT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
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<p>205) SCOPE: <u>This work element applies to the LARW, Class A West, and 11e.(2) embankments.</u></p> <p>206) AERIAL SURVEY REQUIREMENTS: <u>An aerial survey of all areas within 100 feet of Section 32the disposal cells and areas within 100 feet of the respective embankment waste limits shall be performed between August 15 and September 15 each year.</u></p> <p><u>The aerial survey shall be performed by a registered land surveyor.</u></p> <p><u>Survey control points shall be identified in the survey report.</u></p> <p><u>Survey tolerance shall not exceed ± 0.75 ft. Actual tolerance of the survey shall be stated in the report.</u></p> <p>207) ANNUAL AS-BUILT VOLUMES: <u>Calculate embankment volumes from the aerial survey data using AutoCAD or approved equivalent equipment.</u></p> <p><u>As required in I.H.6 of Groundwater Quality Discharge Permit UGW450005, Provide plan view and cross-sections of the as-built embankment based on the aerial survey data. Include in each cross-section the profile of the maximum authorized waste elevation. Also include in each cross-section the elevation profile of the top of the uppermost approved waste lift (as of the time the lift was approved). Provide a clear key to each cross-section to define the meaning of each symbol and line used.</u></p>		

LLRW and 11e.(2) CQA/QC MANUAL
TABLE 1 - QA/QC ACTIVITIES
WORK ELEMENT – ANNUAL AS-BUILT REPORT

SPECIFICATION	QUALITY CONTROL	QUALITY ASSURANCE
<p><u>For each embankment, report the design capacity, capacity used to date, and remaining capacity, including overburden. Compare remaining capacity with the surety reserve capacity for each embankment. Report any volume of waste that is placed over the design top of waste.</u></p>		

LLRW and 11e.(2) CQA/QC MANUAL

TABLE 2

MATERIAL SPECIFICATIONS FOR PORTLAND CEMENT CLSM

PROPERTY	TEST METHOD	MINIMUM	MAXIMUM	FREQUENCY
WET UNIT WEIGHT	ASTM D6023	100 lbs/ft ³	None	1 One Test/ 400-2,000 Cubic Yards/Lift
SLUMP	EnergySolutions Slump Test (Appendix B)	Eight 8 inches	None	One Test/100 Cubic Yards/Lift
-OR- FLOW	EnergySolutions Efflux Test (Appendix B)	NA	26 seconds	One Test/100 Cubic Yards/Lift
-OR- FLOW CONSISTENCY	Flow Consistency (ASTM D6103)	Eight 8 inches	None	One Test/100 Cubic Yards/Lift
28 DAY COMPRESSIVE STRENGTH	ASTM D4832	150 psi	None	One Test/2,000 Cubic Yards Placed at 28 days
CEMENT	None	50 lbs for each cubic yard of CLSM	None	Inspect each load ticket prior to pour
POZZOLAN	None	None	375 lbs for each cubic yard of CLSM	Inspect each load ticket prior to pour
AGGREGATE SIZE	Gradation Test Certificate from Batch Plant ASTM C117 ASTM C136	Percent Passing Sieve 100 3/8" 60 — #8 60 — #8	Percent Passing Sieve 60 — 100 30 200 et the particle size requirements for a sand classification as defined in ASTM D2487.	One Test/ Pour certification per day if material is received from from exterior batch plant or One certification/test per stockpile if material is received from on site batch plant. Gradation certificate shall be received by QC Technician prior to pouring any CLSM